

**TECHNICAL MANUAL
MAINTENANCE INSTRUCTIONS
DEPOT
FAN DRIVE TURBINE MODULE
AIRCRAFT ENGINE
USAF MODEL
F100-PW-229**

**PRATT & WHITNEY
LARGE MILITARY ENGINES
UNITED TECHNOLOGIES CORPORATION
F33657-84-C-2014
F41608-94-D-0816**

THIS PUBLICATION IS ONE OF A SET OF TWELVE MANUALS. THE COMPLETE SET CONSISTING OF T.O. 2J-F100-53-1 THROUGH T.O. 2J-F100-53-11 AND T.O. 2J-F100-11-2 IS REQUIRED FOR DEPOT MAINTENANCE.

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**15 AUGUST 1991
CHANGE 30 — 15 AUGUST 1999**

RECORD OF CHANGES

Original	15 Aug 91	Change 16	15 Nov 95
Change 1	15 Nov 91	Change 17	15 Feb 96
Change 2	15 Feb 92	Change 18	15 May 96
Change 3	15 May 92	Change 19	15 Aug 96
Change 4	15 Nov 92	Change 20	15 Nov 96
Change 5	15 Feb 93	Change 21	15 Feb 97
Change 6	15 May 93	Change 22	15 May 97
Change 7	15 Aug 93	Change 23	15 Aug 97
Change 8	15 Nov 93	Change 24	15 Nov 97
Change 9	15 Feb 94	Change 25	15 Feb 98
Change 10	15 May 94	Change 26	15 Aug 98
Change 11	15 Aug 94	Change 27	15 Nov 98
Change 12	15 Nov 94	Change 28	15 Feb 99
Change 13	15 Feb 95	Change 29	15 May 99
Change 14	15 May 95	Change 30	15 Aug 99
Change 15	15 Aug 95		

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VS-2 Blank Deleted	22	S-6	13
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NUMERICAL INDEX OF EFFECTIVE WORK PACKAGES**NOTE**

Only those work packages assigned to this manual are listed in this index.

Insert Change No. 30 work packages and subordinate work packages, dated 15 August 1999. Dispose of superseded work packages and subordinate work packages. If changed pages are issued to a work package or subordinate work package, insert the changed pages in the applicable work package or subordinate work package. The portion of the text affected in a changed or revised Work package (WP) is indicated by change bars in the outer margin of each column of text. Changes to illustrations are indicated by pointing hands or change bars, as applicable.

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*Zero in this Column Indicates an Original WP/SWP.

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T. O. No.	Date	Level	Title (ECP No.)
2J-F100-890	15 JUL 95	O/I	Modification of PWA57447 puller, F100/200/220/220E/229 Engines, F-15/F-16 Aircraft. (ECP 94QC003)
2J-F100229-553	15 FEB 95	O/I	Modification of PWA 57653 tool set, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 94QC004-1)
2J-F100229-554	15 FEB 95	O/I	Modification of PWA 57704 adapter, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 89QA624-1)
2J-F100229-587	15 Oct 1998	O/I	Reoperation of PWA 57753 Hydraulic Pusher, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 94QC005)
2J-F100229(III)-503	15 MAR 98	D	Rework of Rear Turbine Hub to Ease Assembly, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 90QA132)
2J-F100229(III)-508	01 MAR 94	O/I	Install improved durability fourth blade outer air seal, F100-PW-229 Engine, F-15/F-16 Aircraft. (ECP 91QA300)
2J-F100229(III)-510	15 JUN 98	D	Modification of PN 4081129 No.5 Bearing Inner Support to Provide Optimized No.5 Bearing Fit, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 92QA031)
2J-F100229(III)-516	15 FEB 95	O/I	Remove and replace second stage turbine duct support and segment, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 90QA218)
2J-F100229(III)-517	15 FEB 95	D	Installation of improved durability 4th stage turbine blade PN 4082504, disk PN 4082604, and air seal PN 4082297, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 93QA253R1C1)
2J-F100229(III)-518	15 FEB 95	O/I	Installation of improved durability 4th stage turbine blade PN 4082504, disk PN 4082604, and air seal PN 4082297, F100-PW-229 Engines, F-15 Aircraft. (ECP 93QA253R1)
2J-F100229(III)-525	15 FEB 97	D	Install New Fourth Stage Turbine Air Sealing Brush Seal and Support Assembly PN 4082239
2J-F100229(III)-527	15 JAN 98	D	Installation of Improved Margin Fan Drive Turbine Fasteners, F100-PW-229 Engine, F-15/F-16 Aircraft

SAFETY SUMMARY

INTRODUCTION

This Technical Order (T.O.) describes physical and chemical processes which may require the use of chemicals, solvents, paints, or other commercially available hazardous material. This T.O. also describes maintenance actions which may require handling or use of potentially dangerous parts or equipment.

Personnel performing maintenance procedures and practices included in this T.O. shall be familiar with safety precautions and procedures associated with chemicals and other hazardous materials, parts and equipment. The user of this T.O. shall consult their local safety and health staff and Material Safety Data Sheet (MSDS) concerning any questions on hazardous chemicals, personal protective equipment requirements, and appropriate handling and emergency procedures. The user shall become completely familiar with the manufacturer/supplier information and adhere to the procedures, recommendations, warnings, and cautions of the manufacturer/supplier for the safe use, handling, storage, and disposal of these materials. Disregarding safety precautions and procedures or performing unauthorized maintenance can cause engine or equipment damage, serious injury, illness, or death.

BACKUP WRENCH

When torquing or breaking torque on any tube coupling nut, use a suitable wrench to apply torque to the fitting to which the part is attached. Failure to properly use a backup wrench can result in failure of tubes and accessories due to stress loading during torquing procedures.

BEARING HANDLING

The most common cause of bearing damage is attributed to improper preservation and mishandling. Do not handle bearings with bare hands. Wear approved gloves when handling bearings. Coat bearings with engine oil and store in labeled containers as matched sets. Ensure all bearing components have matching serial numbers before installation to prevent bearing failure due to mismatched contact surfaces.

BRAZING, SOLDERING AND WELDING

Brazing, soldering and welding operations may produce fumes that can be harmful to breathe. Arc welding emits ultraviolet light, which can burn the skin and eyes. Provide adequate ventilation. Wear protective clothing/equipment. Ensure gas bottles are properly secured.

CABLES, ELECTRICAL

Small radius bends or severe flexing of electrical cables can result in damage to conductors and/or outer braid.

SAFETY SUMMARY (continued)

CARBON SEALS AND SEAL SEATS

Carbon seals and carbon seal seats are easily damaged and shall be handled with care. Do not allow carbon seals to come in contact with petroleum based solvents. These solvents will reduce the lubricity of the carbons and result in rapid seal wear. Do not handle carbon seals or seal seats with bare hands. Wear approved, lint free gloves.

CHEMICAL COMPOUNDS AND SOLUTIONS

Many of the chemical compounds and solutions used in cleaning, inspection, and repair may cause irritation to the skin, eyes, and respiratory system. Many of the chemicals, including their vapors, may be poisonous, easily ignited, corrosive, and react violently with incompatible materials. Improper mixing and combining of these chemicals may produce violent reactions, rapid heat generation, and explosive/toxic gases. Heating certain chemicals may cause toxic gases to be produced. Observe manufacturer's warning labels and Material Safety Data Sheet (MSDS) instructions for proper handling, storage, and disposal. Consult the local Safety Office for additional information.

COMPRESSED AIR

Compressed air can generate flying debris and can cause severe injury if air blast penetrates the skin or eyes. Reduce compressed air pressure for cleaning or drying to less than 30 psig. Use with effective chip guarding and personal protective equipment. Do not direct air blast toward other personnel.

COMPRESSED GASES

Many compressed gases are highly flammable/explosive and can cause suffocation at varied levels of concentration or exposure time. Some of the gases can freeze body tissue. Keep ignition sources away. Provide adequate ventilation. Wear protective clothing/equipment. Store in properly marked/labeled containers at approved locations. Do not use in confined areas which may create an explosive atmosphere. Refer to specific Material Safety Data Sheet (MSDS) for additional information.

DANGEROUS PRESSURE

Pressure system precautions apply to all equipment using gases and fluids at all ranges of pressure. To avoid injury, stand clear of tooling and parts being pressure tested when pressure is being applied. Proper tool installation, shielding and hose connections shall be ensured before applying pressure. Ensure all system components are compatible with pressures applied and pressure medium used. Pressure shall be applied slowly.

SAFETY SUMMARY (continued)**ELECTROSTATIC DISCHARGE (ESD)**

Circuit card assemblies and their related components may be damaged by undetectable electrostatic discharge. Care shall be used during handling or repair of these items. Use electrostatic discharge precautionary standard operating procedures.

ENGINE AND ACCESSORIES - TEMPERATURE

Aircraft engines and accessories are extremely hot following operation. Allow sufficient time to cool or wear protective clothing/equipment when maintenance or inspection tasks are required following engine operation. Failure to comply may result in injury to personnel.

ENGINE AND CONTROLS PRESERVATION

Engines and engine controls shall be drained of all fuel and preserved before shipping. Failure to drain fuel can result in a fire hazard. Engine preservation replaces any fuel with oil, which acts as a corrosion preventing agent.

FOREIGN OBJECT DAMAGE (FOD)

Foreign objects can enter engine compartments and accessories during maintenance. Always be aware of the potential for foreign object damage (FOD) entering any uncovered opening of an engine or accessory. Always thoroughly clean parts and compartments to remove all foreign material. Make a final detail inspection of the work area when the job is finished. Follow standard operating procedures for tool and equipment accountability.

FOOD AND TOBACCO

Wash hands and face thoroughly prior to smoking tobacco products or eating food. Residue of the materials used in engine and equipment maintenance can cause serious health problems if ingested or inhaled in the smoke.

HEARING PROTECTION

The frequency and intensity of noise generated during some operations may cause an acute or chronic hearing impairment. Wear approved hearing protection equipment. Contact the local safety office or bioenvironmental engineering for further guidance.

SAFETY SUMMARY (continued)

HYDRAULIC TOOLING

Application of hydraulic pressure to tooling or engine parts can cause them to jump with enough force to cause personal injury. Excessive pressure applied to tooling by a hydraulic pump can cause a structural failure to the engine part and/or the tooling which could result in personal injury. Using a ram with a nonapproved part number or exceeding hydraulic pump pressure can result in excessive pressure being applied to tooling. Do not exceed ram capacity for a given tool. Stand clear of tooling and engine parts during hydraulic tool operations.

JEWELRY

Remove rings, watches, necklaces, and other metallic objects that may be snagged or cause shock or burn hazards.

LEAD SEALS

Lead seals shall only be removed when specifically called for in the procedure. Lead seals identify areas of critical adjustment that can only be attained at the Depot or Vendor level.

LIFTING, ROTATING, AND SUPPORTING

Personnel shall stay clear of objects being lifted during hoist operations or when objects are supported by temporary transition supports. To prevent personal injury, use adequate number of personnel and appropriately rated lifting/handling devices to lift or move objects. Unless specified in the procedures, personnel shall not work on objects suspended by a hoist or supported by temporary transition supports. Personnel shall be prepared for potential unbalanced conditions during hoist operations.

LIVE ELECTRICAL CIRCUITS

Do not work on electrical systems, replace components, or make adjustments to equipment with the electrical supply turned on. Under certain conditions, danger may exist even when the power control is in the ''off'' position due to charges retained by capacitors. To avoid injuries, always remove power from, discharge, and ground a circuit prior to servicing. Adhere to all lock-out/tag-out requirements.

MAINTENANCE STANDS AND FIXTURES

Ensure modules or assemblies are firmly secured to work stands or fixtures before performing maintenance procedures. Personal injury or damage to modules or assemblies may occur if a work stand or fixture slips.

SAFETY SUMMARY (continued)**METAL MACHINING PROCESSES**

Metal machining processes may generate dust, fumes, filings, and/or shavings which may cause acute/chronic irritation to the skin, eyes, digestive tract, and respiratory system. Metallic dust vapors may form a fire hazard when exposed to heat, flame, or when in contact with oxidizing agents. Prior to performing any metal machining process, personnel shall consult their local safety and health staff and the Material Safety Data Sheet (MSDS) to become familiar with the hazards and protective measures for a specific metal.

MOVING ENGINE

Do not move an engine on work stand rails or transportation trailer without having installed proper supports, tie-rods, and flange adapters. Engine may shift or fall off rails and cause injury to personnel. When moving engine, do not push on engine. Use the engine support mount assemblies as a push point.

PACKING LUBRICATION (OIL AND FUEL SYSTEMS)

Use only the lubricant specified in the technical order to lubricate fuel and oil system packings. Use of an incompatible lubricant can cause oil foaming, clogging of critical fuel system filters, and packing deterioration leading to leakage, possible fire and engine shutdown.

PROTECTIVE CLOSURES AND COVERS

Install protective closures on all plumbing and components immediately upon removal. Install protective covers on engine modules, assemblies, parts, and compartments when not being worked.

QUICK RELEASE PINS

Do not force quick release pins into place as this may damage the self-locking feature of the pins. The compatibility of quick release pins is determined by the part number. Intermixing of pin part numbers during installation can result in loss of or failure of the quick release pins.

SHARP EDGED BLADES

Many blades have sharp edges. Wear protective gloves when handling bladed rotors and when installing or removing blades from rotors. Blades should only be used in their designed holder or rotor.

SAFETY SUMMARY (continued)

SUPER-CHILLED/HEATED PARTS AND EQUIPMENT

Super-chilled or heated parts and the equipment or agents used to heat or chill can cause burns, frostbite, or both. Wear temperature resistant gloves and other related protective clothing/equipment when handling chilled or heated parts or equipment. Super-chilled parts are fragile due to a lower resistance to impact. Heating parts beyond specified temperature limits can degrade heat treat qualities and result in part failure.

TEMPERATURE NORMALIZING

Allow heated or chilled parts to reach room temperature before applying final torque to fasteners. Failure to comply may result in improperly seated parts and/or mistorqued fasteners.

WORK BOLTS AND WORK NUTS

Work bolts and work nuts shall be permanently marked to distinguish them from engine bolts and nuts. Do not apply lubricants to work bolts and work nuts that will be replaced by engine bolts and nuts which require a thread sealant. Sealants will not adhere to threads contaminated with lubricants.

WORK PACKAGE

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FAN DRIVE TURBINE MODULE

EFFECTIVITY: ENGINE MODEL F100-PW-229

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Installation - - - - -	611 00
Removal - - - - -	021 00
Ring-Retaining, Turbine Stator, Fourth Stage	
Cleaning - - - - -	201 00
Inspection - - - - -	311 00
Installation - - - - -	611 00
Removal - - - - -	021 00
Rotor and Stator Assembly, Turbine, Front Compressor Drive	
Airflow and Vacuum Checks, Compartment, No 5 Bearing - - - - -	702 00
Disassembly - - - - -	021 00
Dynamic Balance Check - - - - -	613 00
Installation - - - - -	701 00
Tools, Dynamic Balancing, Installation - - - - -	612 00
Tools, Dynamic Balancing, Removal - - - - -	614 00

ALPHABETICAL INDEX (continued)

Subject	WP/SWP/No.
S	
Seal Assembly Face, No. 5 Bearing	
Air Leak Check - - - - -	607 00
Assembly - - - - -	606 00
Cleaning - - - - -	201 00
Disassembly - - - - -	025 00
Inspection - - - - -	330 00
Repair - - - - -	430 00
Seal Assembly, No. 5 Bearing	
Assembly - - - - -	606 00
Cleaning - - - - -	201 00
Disassembly - - - - -	025 00
Inspection - - - - -	325 00
Installation - - - - -	609 00
Removal - - - - -	024 00
Repair - - - - -	425 00
Seal Ring, Metal (No. 5 Bearing Seal, Sealing Ring)	
Assembly - - - - -	606 00
Disassembly - - - - -	025 00
Seat-Ball, Socket, No. 5 Bearing Support	
Assembly - - - - -	606 00
Cleaning - - - - -	201 00
Disassembly - - - - -	025 00
Inspection - - - - -	327 00
Seat, No. 5 Bearing Seal	
Cleaning - - - - -	201 00
Disassembly - - - - -	012 00
Inspection - - - - -	333 00
Installation - - - - -	701 00
Seat, Turbine Shaft Lock	
Cleaning - - - - -	201 00
Inspection - - - - -	340 00
Installation - - - - -	608 00
Removal - - - - -	026 00
Repair - - - - -	440 00
Seat-Valve, Oil Check	
Assembly - - - - -	606 00
Cleaning - - - - -	201 00
Disassembly - - - - -	025 00
Inspection - - - - -	337 00
Segments, Air Sealing Ring, Assembly Fourth Stage	
Cleaning - - - - -	201 00
Disassembly - - - - -	021 00
Inspection - - - - -	321 00
Installation - - - - -	611 00
Removal - - - - -	021 00
Repair - - - - -	421 00

ALPHABETICAL INDEX (continued)

Subject	WP/SWP/No.
Segments, Air Sealing Ring, Assembly, Third Stage	
Cleaning - - - - -	201 00
Disassembly - - - - -	021 00
Inspection - - - - -	303 00
Installation - - - - -	611 00
Repair - - - - -	403 00
Shaft Assembly, Front Compressor Drive Turbine	
Assembly - - - - -	601 00
Cleaning - - - - -	201 00
Disassembly - - - - -	031 00
Dynamic Balancing - - - - -	601 00
Dynamic Balancing Check - - - - -	613 00
Inspection - - - - -	302 00
Installation - - - - -	611 00
Removal - - - - -	021 00
Repair - - - - -	402 00
Tools, Dynamic Balancing, Installation - - - - -	612 00
Tools, Dynamic Balancing, Removal - - - - -	614 00
Shield, Heat, Front Compressor Driveshaft	
Cleaning - - - - -	201 00
Inspection - - - - -	345 00
Installation - - - - -	611 00
Removal - - - - -	031 00
Shield, Heat, No. 5 Bearing	
Cleaning - - - - -	201 00
Installation - - - - -	609 00
Removal - - - - -	024 00
Shipping Container, Fan Drive Turbine Module	
Installation - - - - -	003 00
Removal - - - - -	003 00
Spacer, No. 5 Bearing Heat Shield	
Cleaning - - - - -	201 00
Installation - - - - -	609 00
Removal - - - - -	024 00
Stator Assembly, Fourth Stage	
Assembly - - - - -	604 00
Cleaning - - - - -	201 00
Disassembly - - - - -	028 00
Inspection - - - - -	309 00
Installation - - - - -	611 00
Removal - - - - -	021 00
Repair - - - - -	409 00

ALPHABETICAL INDEX (continued)

Subject	WP/SWP/No.
Stator Assembly, Third Stage	
Assembly - - - - -	602 00
Cleaning - - - - -	201 00
Disassembly - - - - -	027 00
Inspection - - - - -	305 00
Installation - - - - -	611 00
Removal - - - - -	021 00
Repair - - - - -	405 00
Stiffeners, Turbine Shaft	
Cleaning - - - - -	201 00
Inspection - - - - -	343 00
Installation - - - - -	601 00
Removal - - - - -	031 00
Repair - - - - -	443 00
Stop-Oil, Check Valve	
Assembly - - - - -	606 00
Cleaning - - - - -	201 00
Disassembly - - - - -	025 00
Inspection - - - - -	338 00
Support, Air Sealing Ring, Fourth Stage	
Cleaning - - - - -	201 00
Disassembly - - - - -	021 00
Inspection - - - - -	319 00
Installation - - - - -	611 00
Removal - - - - -	021 00
Repair - - - - -	419 00
Support and Duct Set, Turbine Rear	
Assembly - - - - -	611 00
Cleaning - - - - -	201 00
Disassembly - - - - -	012 00
	021 00
Inspection - - - - -	304 00
Installation - - - - -	701 00
Repair - - - - -	404 00
Support Assembly, No. 5 Bearing Inner - No. 5 Bearing Inner Race and Rollers	
Assembly - - - - -	610 00
Cleaning - - - - -	201 00
Disassembly - - - - -	030 00
Inspection - - - - -	335 00
Installation - - - - -	701 00
Removal - - - - -	012 00
Repair - - - - -	435 00

ALPHABETICAL INDEX (continued)

Subject	WP/SWP/No.
T	
Tierod, Turbine	
Assembly - - - - -	603 00
Cleaning - - - - -	201 00
Disassembly - - - - -	022 00
Installation - - - - -	603 00
V	
Valve-Oil, Check	
Assembly - - - - -	606 00
Cleaning - - - - -	201 00
Disassembly - - - - -	025 00
Inspection - - - - -	339 00
Vane, Turbine Stator, Fourth Stage	
Assembly - - - - -	604 00
Cleaning - - - - -	201 00
Disassembly - - - - -	028 00
Inspection - - - - -	307 00
Repair - - - - -	407 00
Vane, Turbine Stator, Third Stage	
Assembly - - - - -	602 00
Cleaning - - - - -	201 00
Disassembly - - - - -	027 00
Inspection - - - - -	306 00
Repair - - - - -	406 00

WORK PACKAGE

INTRODUCTION

FAN DRIVE TURBINE MODULE

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 10

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	23	5	15	8 Blank	0
3	8	6	0	9	15
4	11	7	14	10 Blank	0

1. INTRODUCTION.

- a. This technical order contains depot maintenance instructions for the Fan Drive Turbine Module.

2. CONTENTS, ARRANGEMENT, AND NUMBERING WORK PACKAGES.

- a. This technical order contains work packages (WP) arranged in functional groups. A block of five digit numbers has been reserved for each group.
- b. The first WP in each functional group is the introductory work package. The introductory work package provides a listing of all the work packages within that group by title and number.

WP Block Numbers	Subject
001 00	Alphabetical Index
002 00	Introduction
003 00	Module Removal/ through 009 Installation in Shipping 00 Container
010 00	Module Dismantling through 019 00
020 00	Disassembly of through 199 Subassemblies 00

WP Block Numbers	Subject
200 00	Cleaning through 299 00
300 00	Inspection through 399 00
400 00	Repair through 499 00
500 00	Open through 599 00
600 00	Assembly of through 699 Subassemblies 00
700 00	Final Assembly through 799 00
800 00	Table of Limits through 899 00

2A. CHANGE REQUESTS

- a. Recommendations for specific changes to this technical order shall be submitted on an AFTO Form 22 to SA-ALC/LPCQ (TOMA), Kelly AFB, TX 78241-6421 in accordance with T.O. 00-5-1.

3. PICTORIAL INDEX.

(See FO-1 and Table 1.)

- a. The pictorial index is used to identify each work package and associated part requiring depot maintenance.

4. LEADING PARTICULARS.

- a. The following is a list of leading particulars for the Fan Drive Turbine Module.

FAN DRIVE TURBINE MODULES

Diameter: 31.25 inches
Length: 86 inches (including
Weight: shaft)
419 pounds (dry weight)

5. TYPICAL PART NUMBER.

- a. When the word typical precedes a part number, that part number is one of several that may be used in that location. By referring to a typical part number in the Illustrated Parts Breakdown (T.O. 2J-F100-54), all applicable part numbers can be found.
- b. Instructions in this technical order for a typical part number also apply to the other (superseding) part numbers. When a part number is used without the word typical, it means that the procedure applies only to that part number.

6. LOCALLY MANUFACTURED SUPPORT EQUIPMENT.

- a. Locally manufactured support equipment may be manufactured by the using activity or by a supplier.
- b. Locally manufactured support equipment is listed in the Master Numerical List of Support Equipment in T.O. 2J-F100-53-3, and the Applicable Support Equipment and Illustrated Support Equipment sections of maintenance WPs/SWPs.
- c. Locally manufactured support equipment is identified in these WPs/SWPs by the prefix LM and a four digit number (LM 0123), or by the prefix LM followed by the PWA number (LM PWA 51203).
- d. When an LM tool is identified in a maintenance WP/SWP, all data required to make the tool will be found in T.O. 2J-F100-53-3, WP 050 00.

Table 1. Fan Drive Turbine Module - Pictorial Index
(See FO-1.)

INDEX NO.	NAME	REM	DISASSY	CLEAN	INSP	REPAIR	ASSY	INSTL	OTHER
1	FAN DRIVE TURBINE MODULE		010 00	200 00	300 00	400 00	600 00	700 00	004 00 (*a) 005 00 (*b) 011 00 (*c) 702 00 (*d) 703 00 (*e) 801 00 (*1)
2	SEAT, TURBINE SHAFT LOCK	026 00	-	201 00	340 00	440 00	-	608 00	-
3	AIR SEALING RING ASSEMBLY	-	024 00	201 00	318 00	418 00	609 00	701 00	-
4	DUCT, TURBINE EXHAUST ASSEMBLY (FRONT)	-	024 00	201 00	341 00	441 00	609 00	-	-
5	CASE, TURBINE EXHAUST	012 00	024 00	201 00	324 00	424 00	611 00	701 00	-
6	DUCT, TURBINE EXHAUST ASSEMBLY (REAR)	-	024 00	201 00	342 00	442 00	-	609 00	-
7	SEAL, ASSEMBLY, NO. 5 BEARING	024 00	025 00	201 00	325 00	425 00	606 00	609 00	-
7A	SHIELD, HEAT, NO. 5 BEARING	024 00	-	201 00	347 00	-	-	609 00	-
7B	SPACER, NO. 5 BEARING HEAT SHIELD	024 00	-	201 00	348 00	-	-	609 00	-
8	NO. 5 BEARING ASSEMBLY	-	012 00 030 00	201 00	332 00	-	-	610 00 701 00	-
9	NUT, BEARING RETAINING (EXTERNALLY THREADED)	-	012 00	201 00	326 00	-	-	701 00	-
10	SEAT, NO. 5 BEARING, SEAL	-	012 00	201 00	333 00	-	-	701 00	-
11	NUT, BEARING RETAINING (INTERNALLY THREADED)	-	012 00	201 00	334 00	-	-	701 00	-
12	WASHER, KEY	012 00	-	201 00	-	-	-	701 00	-
12A	GUIDE, NO. 5 BEARING ROLLER (WITHOUT LOCKING TABS)	012 00	-	201 00	323 00	-	-	701 00	-
12B	GUIDE, NO. 5 BEARING ROLLER (WITH LOCKING TABS)	012 00	-	201 00	323 00	-	-	701 00	-
12C	RING, RETAINING	012 00	-	-	-	-	-	701 00	-
13	NUT, BEARING RETAINING (INTERNALLY THREADED)	-	030 00	201 00	331 00	-	610 00	-	-
14	SUPPORT, NO. 5 BEARING, INNER	012 00	030 00	201 00	335 00	435 00	610 00	701 00	-
15	SEAT, OIL CHECK VALVE	-	025 00	201 00	337 00	-	606 00	-	-
16	STOP, OIL CHECK VALVE	-	025 00	201 00	338 00	-	606 00	-	-
17	VALVE, OIL CHECK	-	025 00	201 00	339 00	-	606 00	-	-
18	CAP, OIL CHECK VALVE	-	025 00	201 00	336 00	-	606 00	-	-

Table 1. Fan Drive Turbine Module - Pictorial Index (continued)
(See FO-1.)

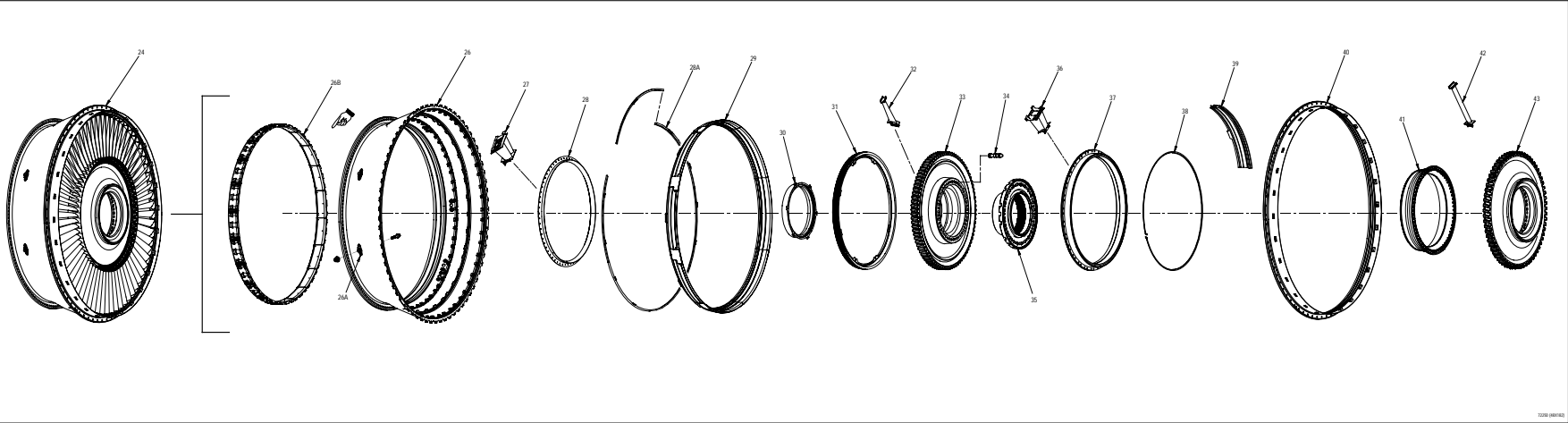
INDEX NO.	NAME	REM	DISASSY	CLEAN	INSP	REPAIR	ASSY	INSTL	OTHER
19	SEAT, BALL SOCKET, NO. 5 BEARING SUPPORT	-	025 00	201 00	327 00	-	606 00	-	
20	BALL END, ROD NO. 5 BEARING SUPPORT	-	025 00	201 00	328 00	428 00	606 00	-	
21	DELETED								
22	SEAL ASSEMBLY FACE, NO. 5 BEARING	-	025 00	201 00	330 00	430 00	606 00	-	607 00 (*f)
23	NUT, COMPRESSOR DRIVE SHAFT, FRONT	-	011 00	201 00	301 00	401 01	-	611 00	-
24	ROTOR/STATOR ASSEMBLY FRONT COMPRESSOR DRIVE TURBINE	-	021 00	-	-	-	-	701 00	612 00 (*g) 613 00 (*h) 614 00 (*i) 702 00 (*d)
25	SHAFT, FRONT COMPRESSOR DRIVE, TURBINE	021 00	031 00	201 00	302 00	402 00	601 00	611 00	601 00 (*j) 612 00 (*g) 613 00 (*h) 614 00 (*i)
25A	STIFFENER - TURBINE SHAFT (FRONT)	031 00	-	201 00	343 00	443 00	-	601 00	
25B	STIFFENER - TURBINE SHAFT (REAR)	031 00	-	201 00	343 00	443 00	-	601 00	
25C	SHIELD, HEAT, FRONT COMPRESSOR DRIVE SHAFT	031 00	-	201 00	344 00	-	-	611 00	
25D	PLUG, NO. 5 BEARING	031 00	-	201 00	345 00	445 00	-	611 00	
26	CASE ASSEMBLY, TURBINE REAR	012 00	021 00	201 00	304 00	404 00	611 00	701 00	
26A	BOSS, INSTRUMENTATION	021 00	-	201 00	304 00	404 00	-	611 00	
26B	SUPPORT AND DUCT SET, TURBINE, SECOND STAGE	021 00	-	201 00	304 00	404 00	-	611 00	
27	VANE, STATOR THIRD STAGE TURBINE	-	027 00	201 00	306 00	406 00	602 00	-	
28	RING ASSEMBLY, AIR SEALING THIRD STAGE TURBINE	021 00	027 00	201 00	305 00	405 00	602 00	611 00	
28A	RING - RETAINING SEGMENT, THIRD STAGE	021 00	-	201 00	346 00	-	-	611 00	
29	RING SEGMENT ASSEMBLY, AIR SEALING, THIRD STAGE	-	021 00	201 00	303 00	403 00	-	611 00	
30	RING, AIR SEALING THIRD STAGE (INNER)	-	022 00	201 00	308 00	408 00	603 00	-	

Table 1. Fan Drive Turbine Module - Pictorial Index (continued)
(See FO-1.)

INDEX NO.	NAME	REM	DISASSY	CLEAN	INSP	REPAIR	ASSY	INSTL	OTHER
31	SEAL, AIR TURBINE, THIRD STAGE		022 00	201 00	310 00	-	603 00	-	
32	BLADE, TURBINE ROTOR, THIRD STAGE		022 00	201 00	313 00	413 00	603 00	-	315 00 (*k)
33	DISK, ASSEMBLY, THIRD STAGE	021 00	022 00	201 00	312 00	412 00	603 00	611 00	
34	TIEROD TURBINE		022 00	201 00	316 00	-	603 00	-	
35	HUB, ASSEMBLY TURBINE REAR	021 00		201 00	317 00	417 00	603 00	-	
36	VANE, STATOR FOURTH STAGE TURBINE		028 00	201 00	307 00	407 00	604 00	-	
37	RING ASSEMBLY, AIR SEALING FOURTH STAGE	021 00	028 00	201 00	309 00	409 00	604 00	611 00	
38	RING, RETAINING FOURTH STAGE STATOR	021 00	-	201 00	311 00	-	-	611 00	
39	RING SEGMENT, AIR SEALING, TURBINE, FOURTH STAGE	021 00	021 00	201 00	321 00	421 00	-	611 00	
40	SUPPORT, TURBINE AIR SEALING RING, FOURTH STAGE	021 00	021 00	201 00	319 00	419 00	-	611 00	-
41	SEAL, AIR, TURBINE, FOURTH STAGE		021 00	201 00	320 00	-	-	611 00	
42	BLADE, TURBINE ROTOR, FOURTH STAGE		023 00	201 00	314 00	414 00	605 00		315 00 (*k)
43	DISK ASSEMBLY, FOURTH STAGE	021 00	023 00	201 00	322 00	422 00	605 00	611 00	

- (*a) 004 00 FAN DRIVE TURBINE MODULE - REMOVAL FROM SHIPPING CONTAINER
- (*b) 005 00 FAN DRIVE TURBINE MODULE - INSTALLATION INTO SHIPPING CONTAINER
- (*c) 011 00 FAN DRIVE TURBINE MODULE - INSTALLATION INTO VERTICAL BUILD STAND
- (*d) 702 00 COMPARTMENT, NO. 5 BEARING - AIRFLOW AND VACUUM CHECKS
- (*e) 703 00 FAN DRIVE TRANSFER FROM BUILD STAND TO PWA 10673 TRUCK
- (*f) 607 00 SEAL, NO. 5 BEARING - AIR LEAK CHECK
- (*g) 612 00 TOOLS, DYNAMIC BALANCING - INSTALLATION
- (*h) 613 00 ROTOR AND STATOR ASSEMBLY, FRONT COMPRESSOR DRIVE TURBINE - DYNAMIC BALANCING CHECK
- (*i) 614 00 TOOLS, DYNAMIC BALANCING - REMOVAL
- (*j) 601 00 SHAFT ASSEMBLY, FRONT COMPRESSOR DRIVE TURBINE - ASSEMBLY AND DYNAMIC BALANCING
- (*k) 315 00 FAN DRIVE TURBINE MODULE - SERVICE CYCLE MARKING
- (*l) 801 00 TABLE OF LIMITS AND CLEARANCE INDEX CHARTS





FO-1. Fan Drive Turbine Module - Pictorial Index (Sheet 2 of 2)

WORK PACKAGE

INTRODUCTION

FAN DRIVE TURBINE MODULE -

REMOVAL FROM AND INSTALLATION INTO SHIPPING CONTAINER

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 2

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2					0

1. INTRODUCTION.

This work package introduces the 003 00 through 009 00 series of work packages for removal from and installation into the shipping container. The following work packages are included in this series:

WP/SWP No.	Title
004 00	Fan Drive Turbine Module - Removal From Shipping Container
005 00	Fan Drive Turbine Module - Installation Into Shipping Container
006 00 through 009 00	Open

WORK PACKAGE**TECHNICAL PROCEDURES****FAN DRIVE TURBINE MODULE -****REMOVAL FROM SHIPPING CONTAINER****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 10

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	25	4 - 4A	23	6	15
2	23	4B Blank Added	19	7	25
3	19	5	19	8	15

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

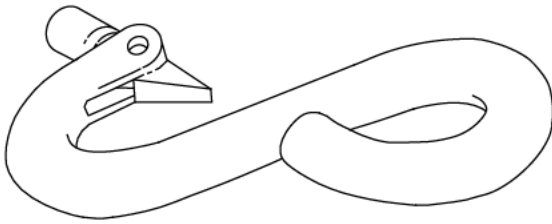
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

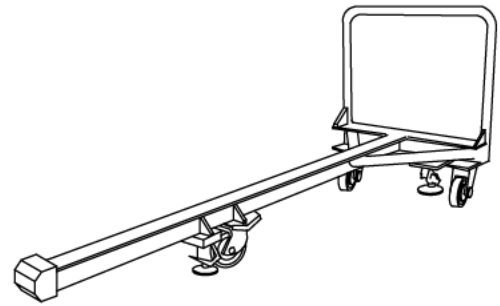
Paragraph	Function - Tool Nomenclature	Tool Number
2	FAN DRIVE TURBINE MODULE - REMOVAL FROM SHIPPING CONTAINER	
	SLING, HANDLING (TWO REQUIRED) - - - - -	PWA 56336
	HOOK - - - - -	PWA 2388
	RETAINER, FAN DRIVE TURBINE MODULE, REAR (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57824
		OR
	RETAINER ASSY - - - - -	PWA 57709
	PROTECTOR, SPLINE, FRONT COMPRESSOR DRIVE TURBINE SHAFT (FRONT) - - - - -	PWA 52647
	ADAPTER, LIFT AND TRUNNION, FAN DRIVE TURBINE MODULE (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57766
	ADAPTER, LIFT AND TRUNNION (TWO REQUIRED) - - - - -	PWA 26147
	RETAINER, FAN DRIVE TURBINE MODULE, FRONT (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57819
		OR
	RETAINER ASSY - - - - -	PWA 57648
		OR
	RETAINER, FRONT, FAN DRIVE TURBINE MODULE - - - - -	PWA 56682
	SUPPORT, FAN DRIVE TURBINE MODULE - - - - -	PWA 10687
	TRUCK, FAN DRIVE TURBINE MODULE - - - - -	PWA 10673
	PROTECTOR, FRONT COMPRESSOR DRIVE TURBINE ROTOR AND STATOR, FRONT RETAINER - - - - -	PWA 52706
	PROTECTOR, FRONT COMPRESSOR DRIVE TURBINE EXHAUST CASE - - - - -	PWA 52734

ILLUSTRATED SUPPORT EQUIPMENT



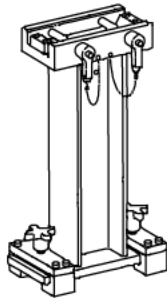
PWA 2388 -C

Figure T1. PWA 2388 HOOK



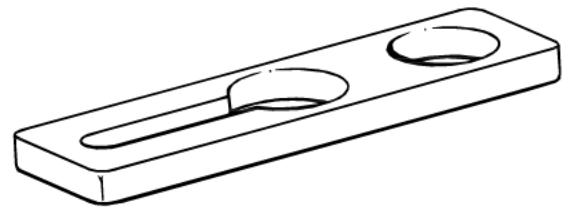
PWA 10673 -C

Figure T2. PWA 10673 TRUCK



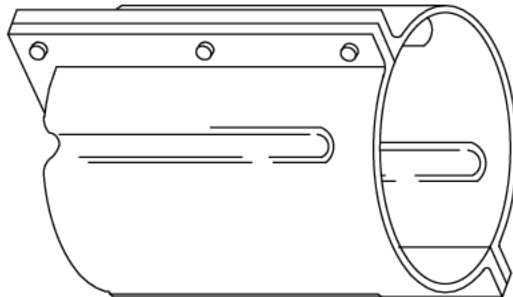
PWA 10687 -C

Figure T3. PWA 10687 SUPPORT



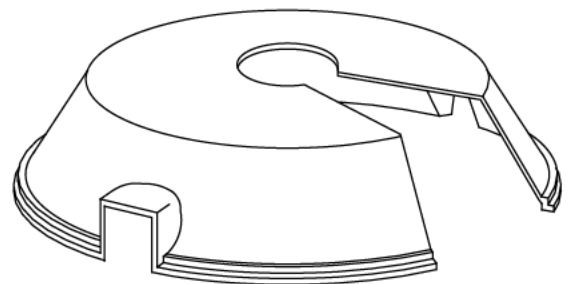
PWA 26147 -C

Figure T4. PWA 26147 ADAPTER



PWA 52647 -C

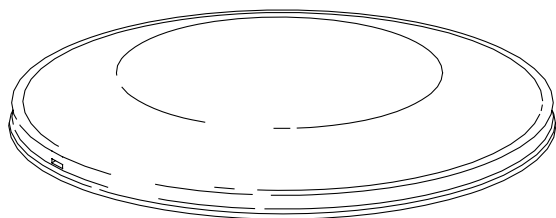
Figure T5. PWA 52647 PROTECTOR



PWA 52706 -C

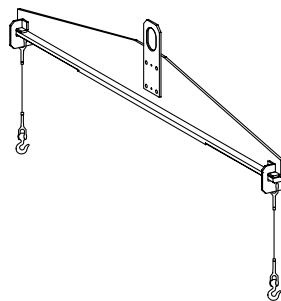
Figure T6. PWA 52706 PROTECTOR

ILLUSTRATED SUPPORT EQUIPMENT (continued)



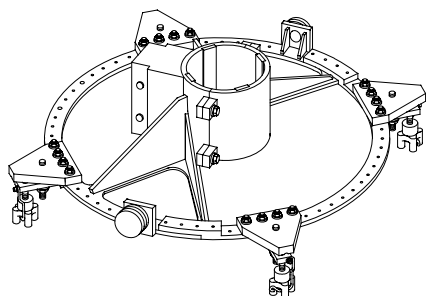
PWA 52734 -C

Figure T7. PWA 52734 PROTECTOR



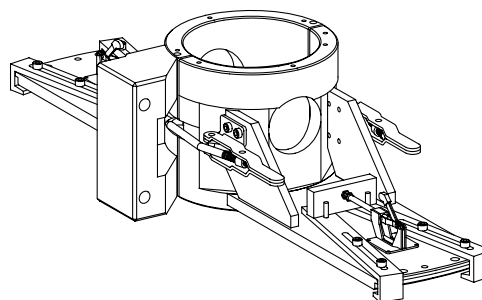
PWA 56336 -C

Figure T8. PWA 56336 SLING



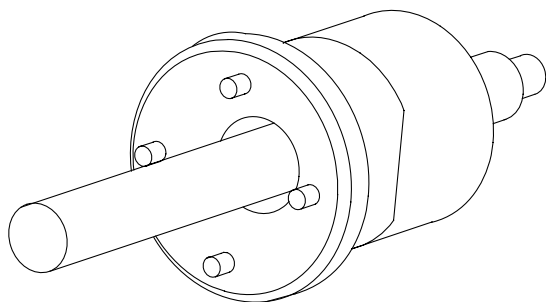
PWA 56682 -C

Figure T9. PWA 56682 RETAINER



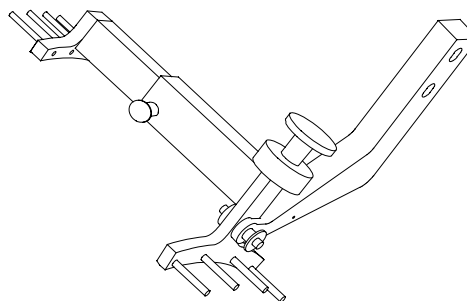
PWA 57648 -C

Figure T10. PWA 57648 RETAINER



PWA 57709 -C

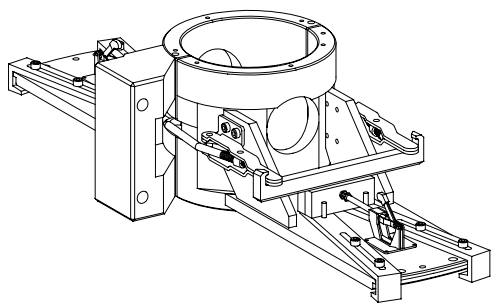
Figure T11. PWA 57709 RETAINER



PWA 57766 -C

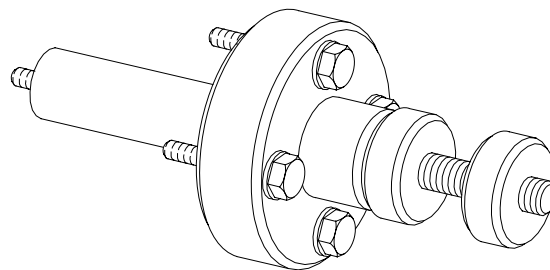
Figure T12. PWA 57766 ADAPTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



PWA 57819 -C

Figure T13. PWA 57819 RETAINER



PWA 57824 -C

Figure T14. PWA 57824 RETAINER

1. INTRODUCTION.

- a. This work package contains instructions for removing fan drive turbine module from shipping container.

2. FAN DRIVE TURBINE MODULE - REMOVAL FROM SHIPPING CONTAINER.

(See Figure 1.)

- a. Remove fan drive turbine module from shipping container. (See figure 1.)

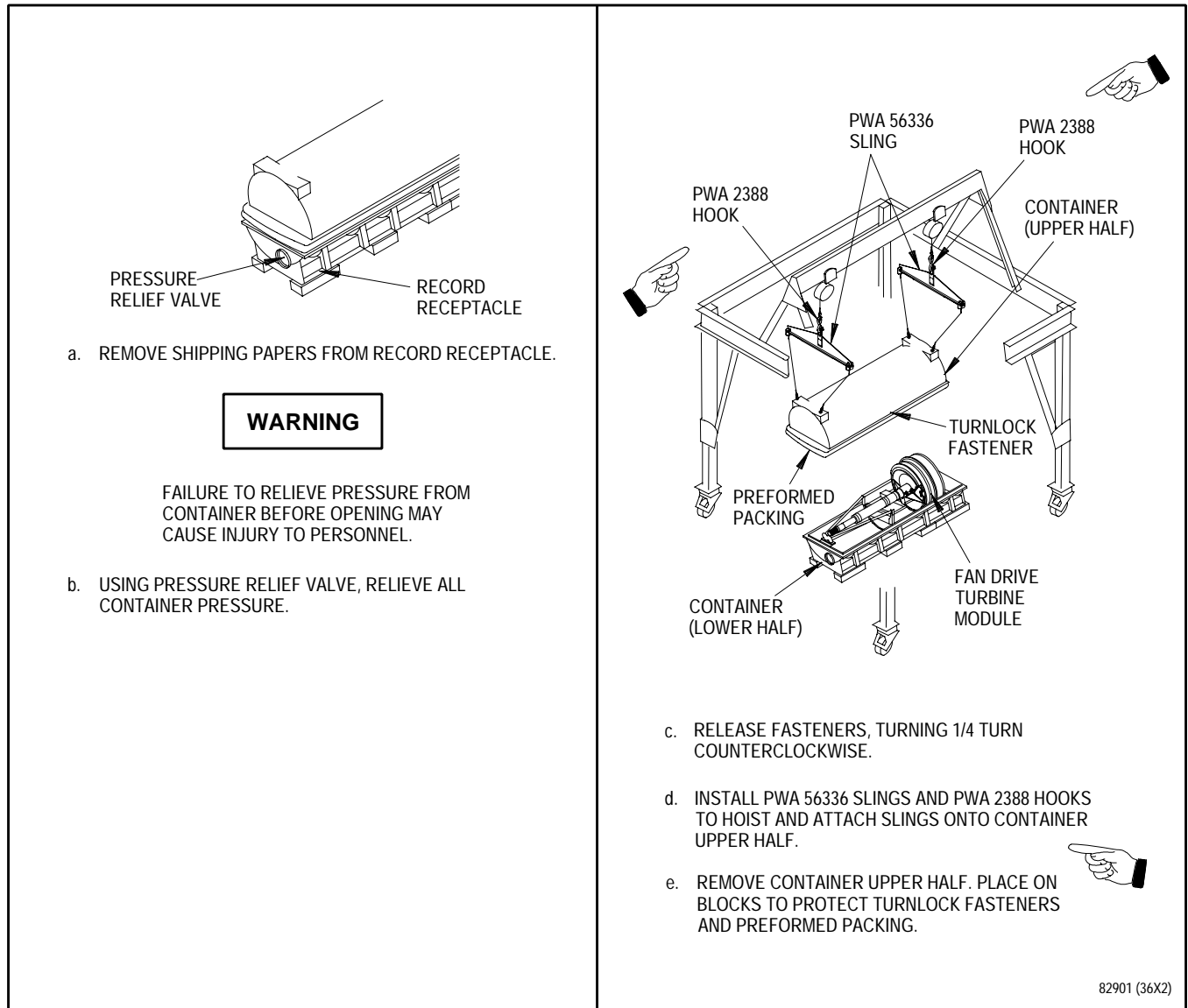
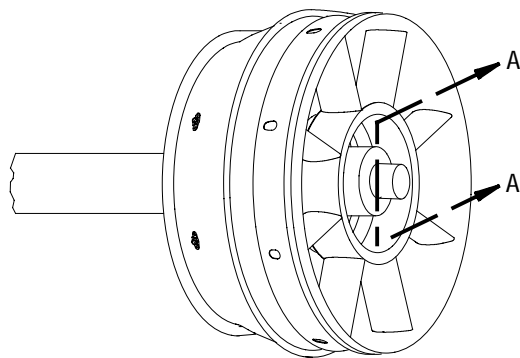
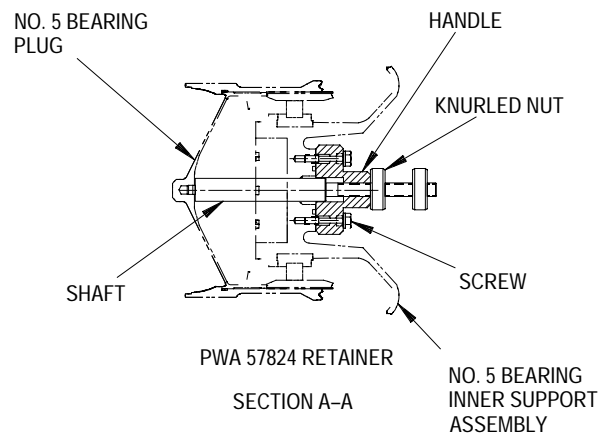


Figure 1. Fan Drive Turbine Module - Removal From Shipping Container (Sheet 1 of 4)

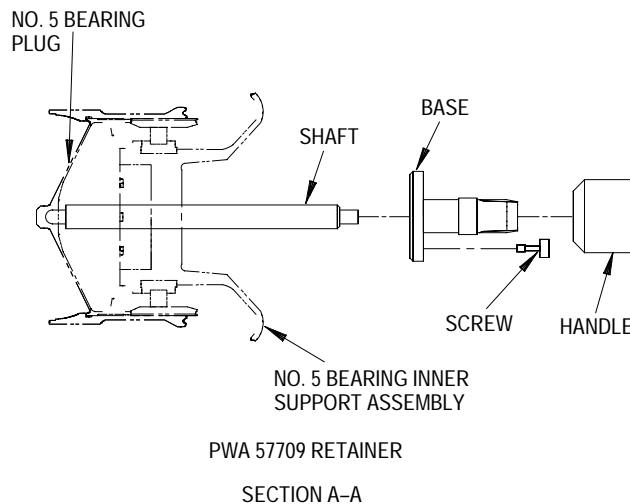
**NOTE**

TURBINE ROTOR AXIAL POSITION MAY BE SECURED USING EITHER PWA 57824 RETAINER PER STEP f. OR PWA 57709 RETAINER PER STEP g.



f. INSTALL PWA 57824 RETAINER AS FOLLOWS:

- ROTATE KNURLED NUT AND HANDLE COUNTERCLOCKWISE ON SHAFT TOWARD KNURLED KNOB END OF SHAFT.
- THREAD SHAFT INTO NO. 5 BEARING PLUG UNTIL SHAFT BOTTOMS. BACK OFF 1/4 TO 1/2 TURN.
- ROTATE HANDLE CLOCKWISE ON SHAFT UNTIL IT CONTACTS NO. 5 BEARING INNER SUPPORT ASSEMBLY. SECURE WITH FOUR SCREWS.
- HANDTIGHTEN KNURLED NUT AGAINST HANDLE.



g. INSTALL PWA 57709 RETAINER AS FOLLOWS:

- THREAD SHAFT INTO NO. 5 BEARING PLUG UNTIL SHAFT BOTTOMS. BACK OFF 1/4 TO 1/2 TURN.
- SLIDE BASE OVER SHAFT AND SEAT BASE ON NO. 5 BEARING INNER SUPPORT ASSEMBLY. SECURE WITH FOUR SCREWS.
- THREAD HANDLE ONTO BASE. HANDTIGHTEN HANDLE.
- THREAD HANDLE ONTO BASE ADDITIONAL 1/3 TURN WITH WRENCH.

72367 (48X2)

Figure 1. Fan Drive Turbine Module - Removal From Shipping Container (Sheet 2 of 4)

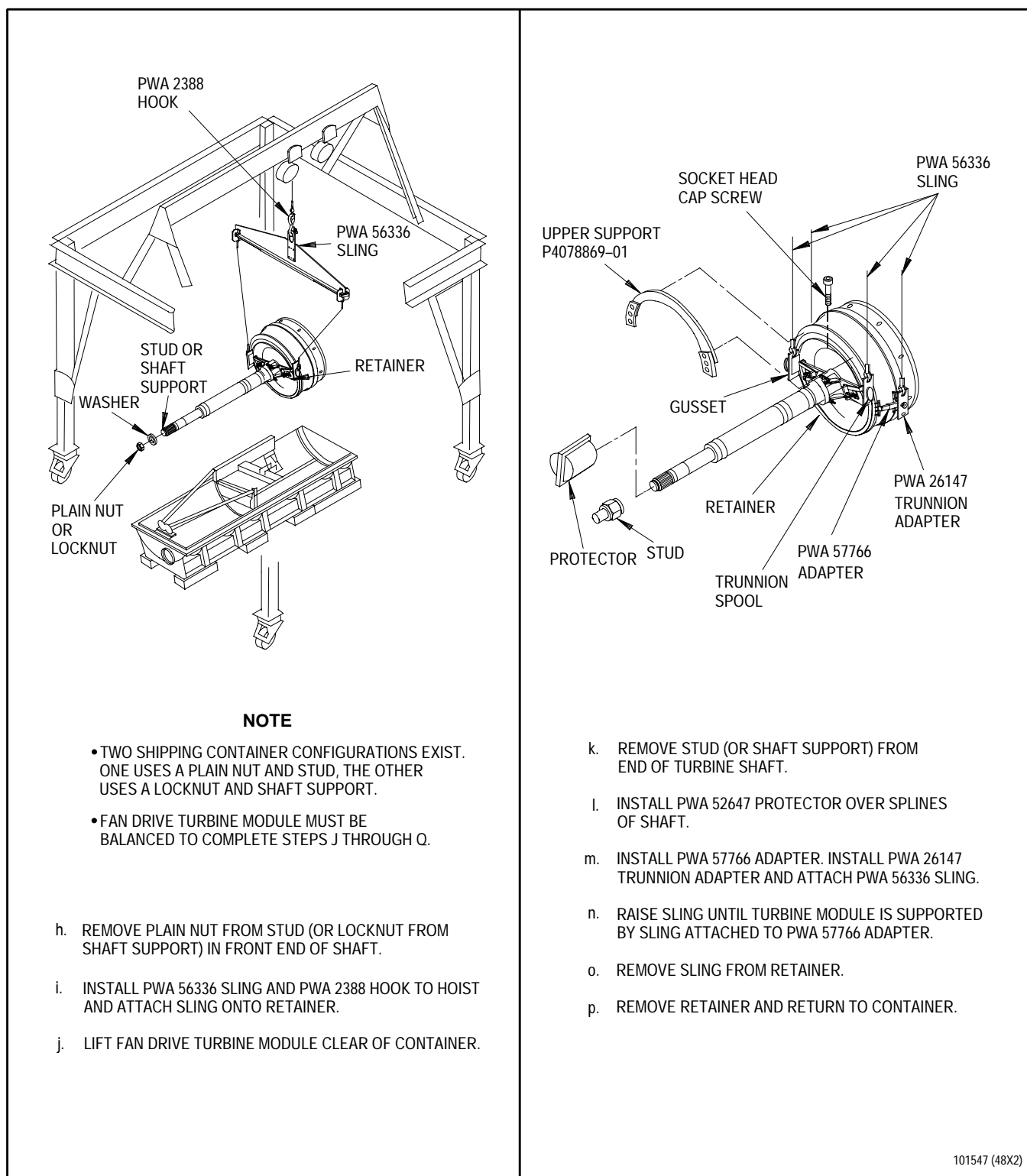
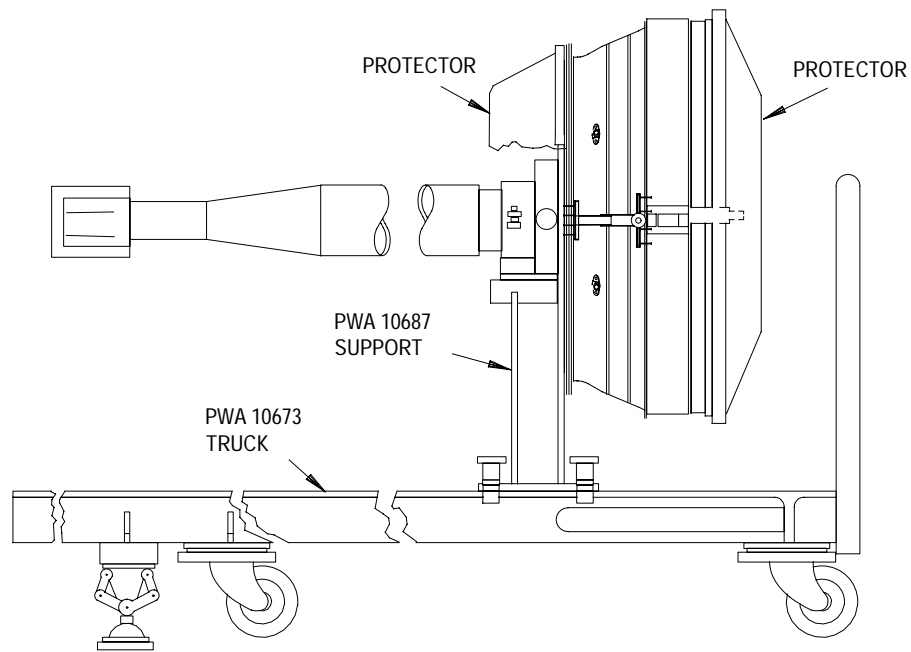


Figure 1. Fan Drive Turbine Module - Removal From Shipping Container (Sheet 3 of 4)



- q. INSTALL PWA 57819 FRONT RETAINER AND CLAMP TO FRONT FLANGE OF TURBINE CASE. ENSURE PUSHER DETAIL-17 LOCK TABS ENGAGE SHAFT CLAMP TOGGLE HANDLES. LOWER FAN DRIVE TURBINE MODULE ONTO PWA 10687 SUPPORT INSTALLED ON PWA 10673 TRUCK AND LOCK IN PLACE WITH BALL LOCK PINS. REMOVE PWA 56336 SLING AND PWA 26147 TRUNNION ADAPTER. REMOVE SHIPPING COVER AND INSTALL PWA 52706 AND PWA 52734 PROTECTORS ON FRONT AND REAR OF MODULE. REASSEMBLE CONTAINER DETAILS AND STORE CONTAINER FOR FUTURE USE.

72368 (36X2)

Figure 1. Fan Drive Turbine Module - Removal From Shipping Container (Sheet 4 of 4)

WORK PACKAGE**TECHNICAL PROCEDURES****FAN DRIVE TURBINE MODULE -****INSTALLATION INTO SHIPPING CONTAINER****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 18

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	25	4B Blank Added	19	9	16
2	15	5	23	10	19
3	23	6	25	11 - 13	25
4	15	7 - 8	15	14 - 16	15
4A	23				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS**Nomenclature**

Compound, antiseize (PWA 36053-3)

Isopropyl alcohol

Specification/Vendor Part Number

Loctite Nickel Antiseize 771
 Loctite Corp.

TT-I-735

EXPENDABLE ITEMS**Nomenclature**

Card, humidity indicator

Consumable packaging parts -
 fan drive turbine module

Cover

Closure, shipping

Desiccant

Lockwire

Seal, lead

Plate, identification

Part Number

P50844

P4078920

* P53391

* P12757

* P8320

* MS20995-C41

* 83280

P52715

Quantity

As required

1

1

7

8

As required

3

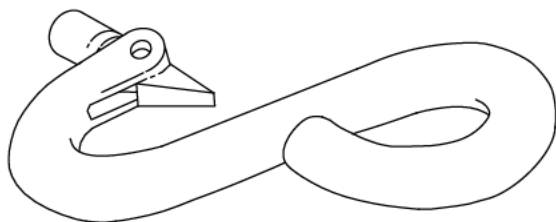
As required

* Details of PN P4021591

APPLICABLE SUPPORT EQUIPMENT

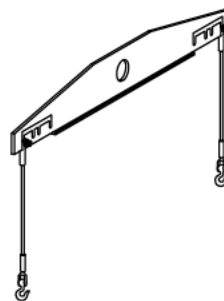
Paragraph	Function - Tool Nomenclature	Tool Number
2	FAN DRIVE TURBINE MODULE - INSTALLATION INTO SHIPPING CONTAINER	
	SLING, HANDLING (TWO REQUIRED) - - - - -	PWA 56336
	SLING, HANDLING - - - - -	PWA 6580
	HOOK, SAFETY - - - - -	PWA 2388
	ADAPTER, LIFT AND TRUNNION (FOUR REQUIRED) - - - - -	PWA 26147
	ADAPTER, LIFT AND TRUNNION, FAN DRIVE TURBINE MODULE (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57766
	RETAINER, FDT MODULE, FRONT - - - - -	PWA 57819
		OR
	RETAINER ASSEMBLY - - - - -	PWA 57648
		OR
	RETAINER, FRONT, FAN DRIVE TURBINE MODULE - - - - -	PWA 56682
	EYE, LIFTING - - - - -	PWA 51056
	RETAINER, FDT, REAR - - - - -	PWA 57824
		OR
	RETAINER ASSEMBLY - - - - -	PWA 57709
	STAND, MODULE STORAGE - - - - -	PWA 56338
	ADAPTER - - - - -	PWA 50996
	ADAPTER, MODULE TO STAND - - - - -	PWA 57839
		OR
	ADAPTER, FDT MODULE TO STAND SHAFT LIP - - - - -	PWA 57708

ILLUSTRATED SUPPORT EQUIPMENT



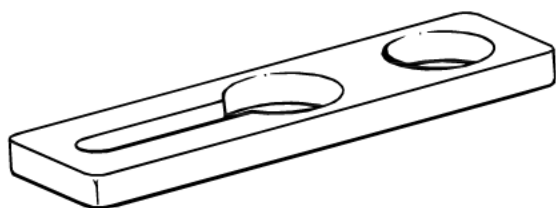
PWA 2388 -C

Figure T1. PWA 2388 HOOK



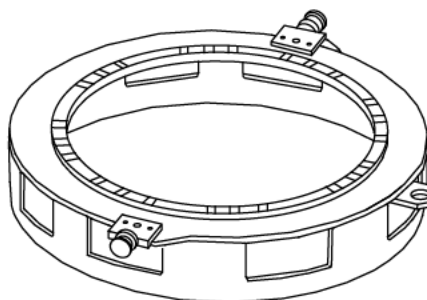
PWA 6580 -C

Figure T2. PWA 6580 SLING



PWA 26147 -C

Figure T3. PWA 26147 ADAPTER



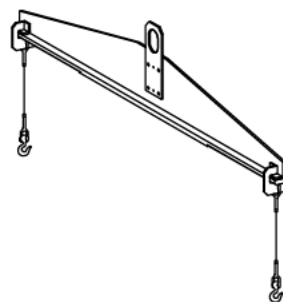
PWA 50996 -C

Figure T4. PWA 50996 ADAPTER



PWA 51056 -C

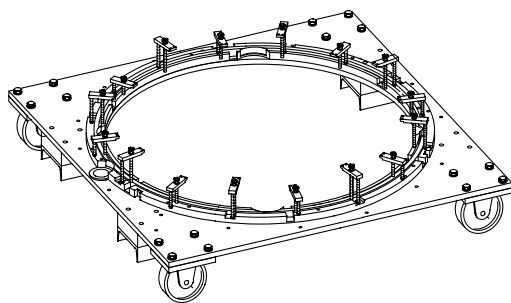
Figure T5. PWA 51056 EYE



PWA 56336 -C

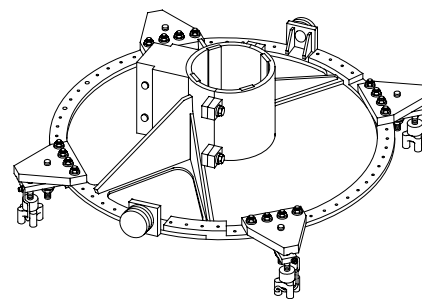
Figure T6. PWA 56336 SLING

ILLUSTRATED SUPPORT EQUIPMENT (continued)



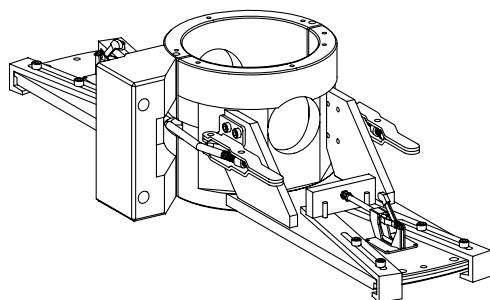
PWA 56338 -C

Figure T7. PWA 56338 STAND



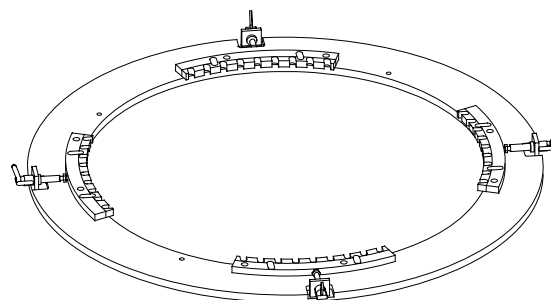
PWA 56682 -C

Figure T8. PWA 56682 RETAINER



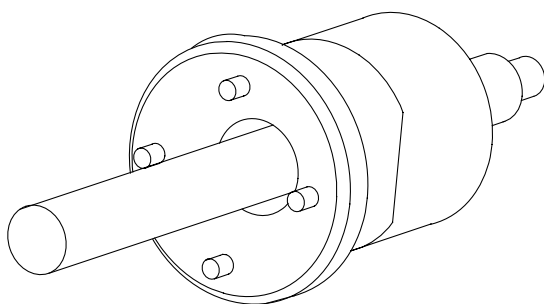
PWA 57648 -C

Figure T9. PWA 57648 RETAINER



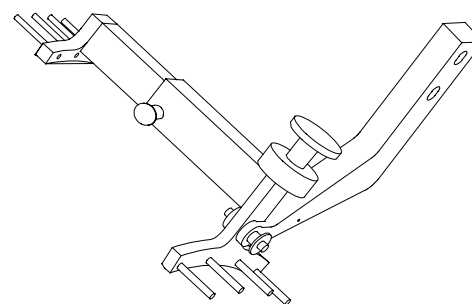
PWA 57708 -C

Figure T10. PWA 57708 ADAPTER



PWA 57709 -C

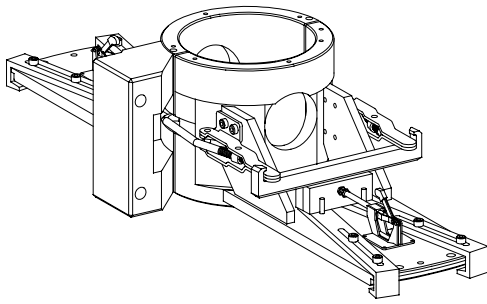
Figure T11. PWA 57709 RETAINER



PWA 57766 -C

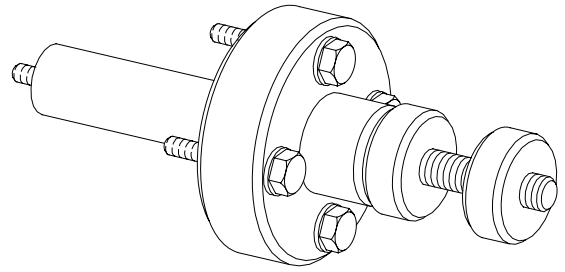
Figure T12. PWA 57766 ADAPTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



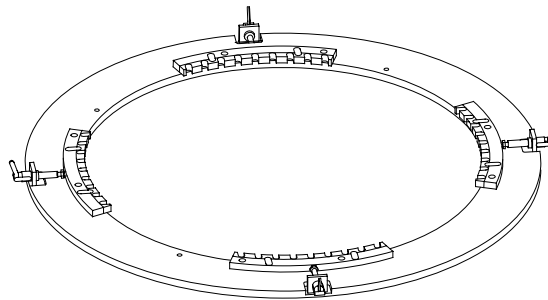
PWA 57819 -C

Figure T13. PWA 57819 RETAINER



PWA 57824 -C

Figure T14. PWA 57824 RETAINER



PWA 57839 -C

Figure T15. PWA 57839 ADAPTER

1. INTRODUCTION.

- a. This work package contains instructions for installing fan drive turbine module into shipping container.

2. FAN DRIVE TURBINE MODULE - INSTALLATION INTO SHIPPING CONTAINER.

(See Figures 1 through 8.)

WARNING

Failure to relieve pressure from container before opening may cause injury to personnel.

- a. Using pressure release valve, relieve all container pressure.
- b. Release fasteners, turning 1/4 turn counterclockwise.
- c. Using two PWA 56336 slings and chain hoists, remove container cover.
- d. Place several wood blocks on floor to support and protect cover flange sealing surface. Lower cover onto blocks.
- e. Check condition of container identification plates on end of container halves. If required, install new container identification plate per paragraph 3.
- f. Remove old desiccant from basket. (See figure 1.)
- g. Clean inside of container lower half.
- h. Check sealing surface of container lower half for any condition which could cause seal leakage. Correct if required.

NOTE

For PN P4078845 shipping container, PWA 56682 retainer is used instead of P4078875 retainer assembly.

- i. Remove retainer assembly from container and disassembly as follows:

- (1) Attach PWA 6580 sling to hoist using PWA 2388 hook.
- (2) Install PWA 26147 trunnion adapters on trunnion spools of retainer assembly and attach PWA 6580 sling.
- (3) Disengage retainer knob from bar knob and unthread bar knob from alignment rod.
- (4) Lift retainer assembly from container and position on bench with clamp assemblies up.
- (5) Remove PWA 26147 trunnion adapters.
- (6) Remove upper ring assembly from P4078875 retainer assembly by removing screws, washers, lockwashers and nuts on both sides, adjacent to locating dowel pins (see figure 2).
For PWA 56682, remove screws attaching upper and lower retainer (see figure 2A).

NOTE

Two shipping container configurations exist. For PN P4078845 shipping container, PWA 56682 retainer assembly is used. For PN P4070537 shipping container, PN 4078875 retainer assembly is used.

- (7) Remove shaft clamp assembly screws and lockwashers or screws and flatwashers, depending on configuration. Remove shaft clamp assembly.

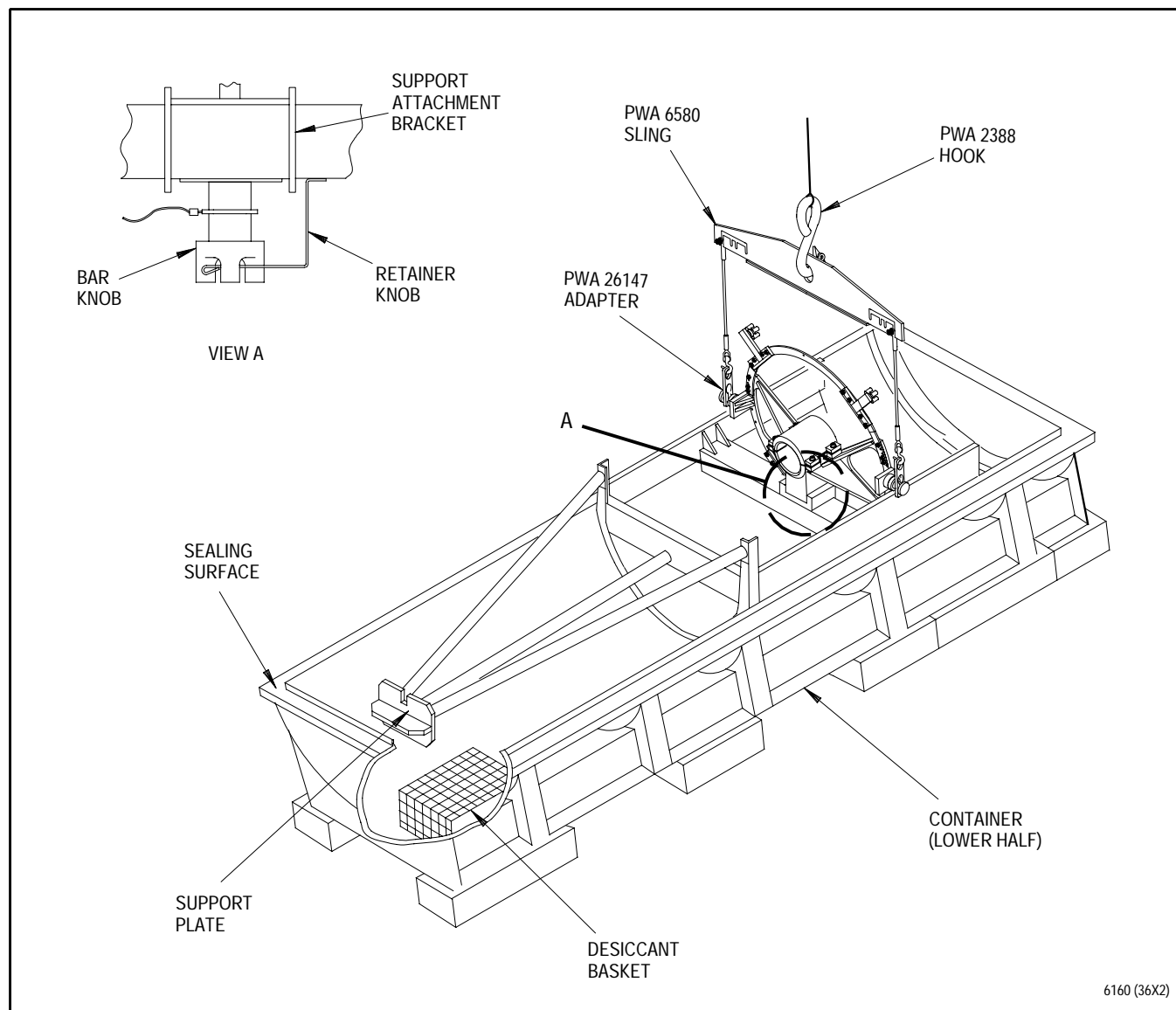


Figure 1. Removal of Retainer P4078875 from Shipping Container

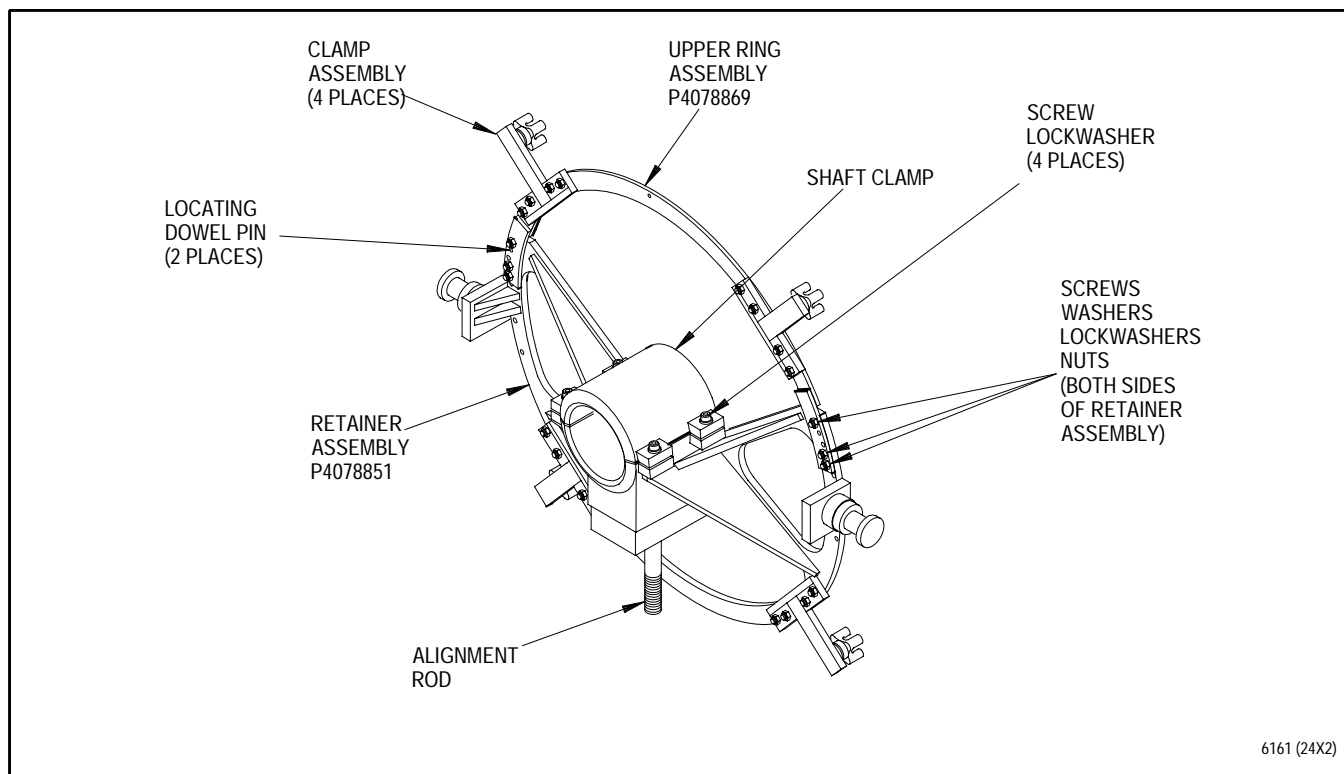


Figure 2. Retainer Assembly P4078875

j. Install fan drive turbine module into vertical build stand as follows:

- (1) Install PWA 57766 adapters between Flange W and Flange Z of fan drive turbine case so that pins of adapter engage holes in outer flange of PWA 57819 retainer. (See figure 3.)
- (2) Attach hoist, PWA 2388 hook, PWA 6580 sling, and PWA 26147 adapters to PWA 57766 adapters.
- (3) Remove protector and thread PWA 51056 eye into front of turbine shaft.
- (4) Connect hoist, and PWA 2388 hook onto PWA 51056 eye.
- (5) Remove protector. Ensure PWA 57824 or PWA 57709 retainer is installed and is secure in rear of module.
- (6) Ensure that flat side of detail-33 ring on PWA 56338 stand is facing up.
- (7) Install and secure PWA 50996 adapter onto PWA 56338 stand.
- (8) Install and secure PWA 57839 adapter onto PWA 50996 adapter. Ensure seven attaching bolts are secure.

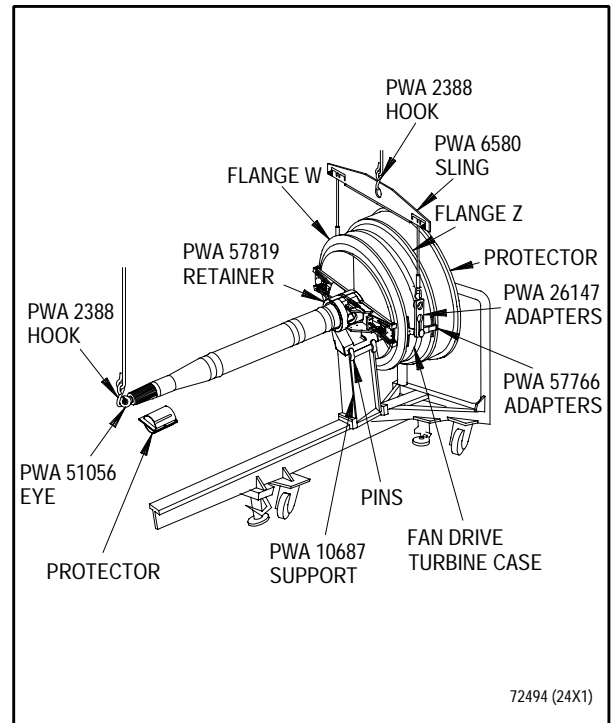


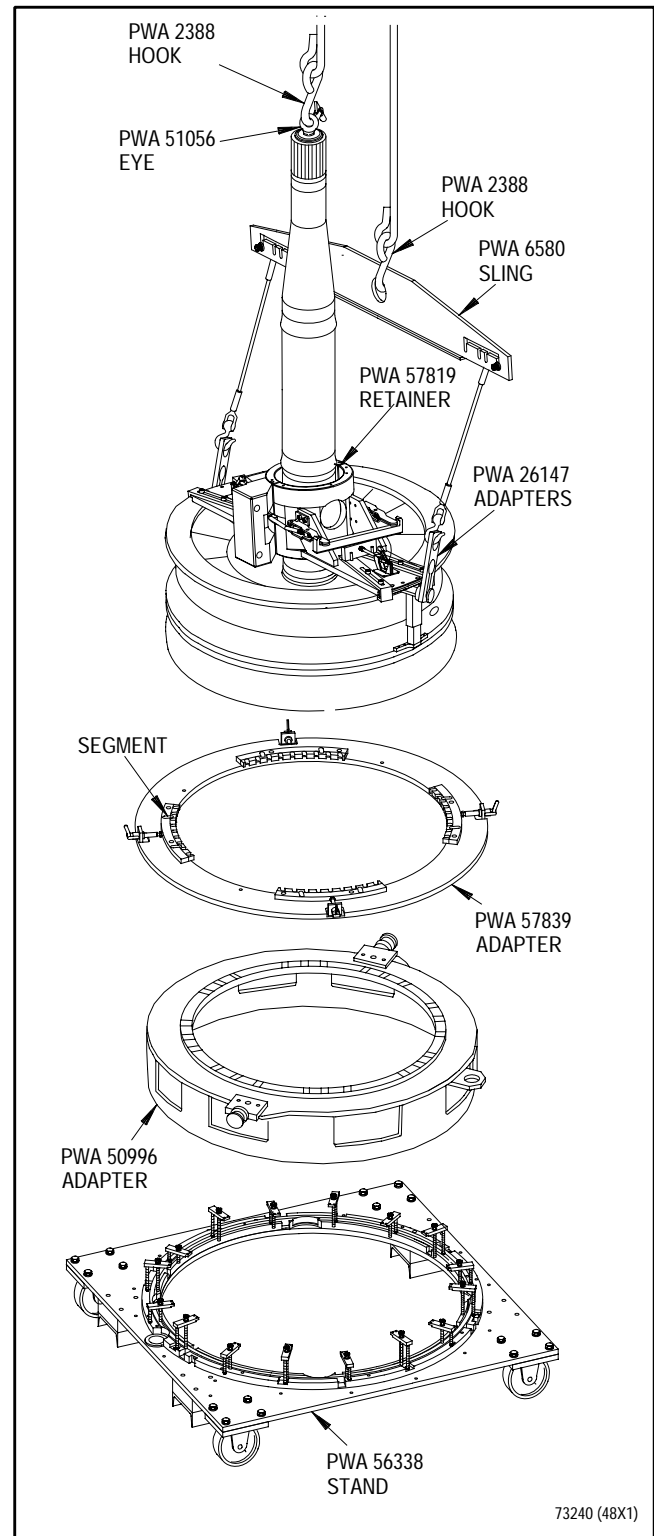
Figure 3. Fan Drive Turbine Module - Installation Into Vertical Build Stand

- (9) Remove pins securing PWA 57819 retainer to PWA 10687 support.
- (10) Carefully lift and rotate turbine module to shaft up position and align with stand. Remove PWA 6580 sling and PWA 26147 adapters from PWA 57766 adapters. (See figure 4.)
- (11) Position PWA 57839 adapter detail-2 segments outward prior to lowering module onto stand.
- (12) Slide detail-2 segments inward to support rear side of Flange Z when Flange Z is approximately two inches from top surface of PWA 57839 adapter.
- (13) Carefully lower turbine module onto stand and support rear side of Flange Z using PWA 57839 adapter detail-2 segments at four locations.
- (14) If necessary, adjust detail-2 segments threaded rod so segments fit flush against Flange Z.



Failure to remove hook, sling and adapters can cause damage to turbine shaft.

- (15) Remove PWA 2388 hook, PWA 6580 sling, PWA 26147 adapters, and PWA 57819 retainer.



73240 (48X1)

Figure 4. Fan Drive Turbine Module - Installation Into Vertical Build Stand

NOTE

Two shipping container configurations exist. For PN P4078845 shipping container, PWA 56682 retainer assembly shall be used. For PN P4070537 shipping container, use PN P4078875 retainer assembly.

k. Determine correct retainer assembly based on shipping container configuration. Install retainer assembly as follows:

- (1) If PWA 56682 retainer assembly is being used, ensure PN P4078947 upper adapter ring and PN P4078932 lower adapter ring are installed. If necessary, install using flat head socket screws.
- (2) Position lower half of retainer assembly on Flange W, clamp assembly knobs down. Clamps can be retracted to clear flange. For PN P4078875 retainer assembly, pins of PWA 57766 adapters can be used to locate retainer assembly on Flange W. (See figure 5.)
- (3) Slide clamp assemblies toward Flange W until round end of stud seats in spherical radius of clamp base.
- (4) Hand tighten clamp assembly knob to snug.
- (5) Ensure clamp rest is snug to Flange and slotted strap is close to parallel with contact surface.
- (6) Turn knob additional 1/4 turn.
- (7) Engage retainer spring to secure knob.

- (8) Install shaft clamp onto retainer assembly and secure with screws and lockwashers or screws and flat washers, depending on configuration.
- (9) Torque shaft clamp screws 200 to 220 pound-inches.
- (10) Position P4078869 upper ring assembly locating holes over dowel pins in P4078851 retainer assembly. Clamp assemblies can be retracted to clear flange.
- (11) Secure upper ring assembly to retainer assembly using screws, washers, lockwashers and nuts.
- (12) Torque nuts 65 to 70 pound-inches.
- (13) Use steps 2 through 6 to secure upper ring assembly clamp assemblies.
- l. Remove PWA 57766 adapters from fan drive turbine module. If not previously accomplished, lubricate threads of bolts (8 each) and washer face of nuts (8 each) with PWA 36053-3 antiseize compound, reinstall flange bolts and torque 32 to 36 pound-inches.
- m. Connect hoist to PWA 51056 lifting eye.
- n. Install PWA 26147 trunnion adapters on trunnion spools of P4078875 retainer assembly and attach hoist.
- o. Raise module from stand until weight is off PWA 57839 adapter and slide segments outward. Raise module from stand and rotate to horizontal position. (See figure 6.)

NOTE

Fan drive turbine module must be balanced to complete steps p. through u.

p. Balance module by holding down on splined end of shaft and disconnect hoist from PWA 51056 lifting eye and remove.

q. Install P4078914 shaft support or P4078949 stud, depending on configuration, into front end of fan drive turbine module shaft.

r. Position module over container with alignment rod above hole in support attachment bracket and shaft support above support plate.

s. Lower module in place on container support.

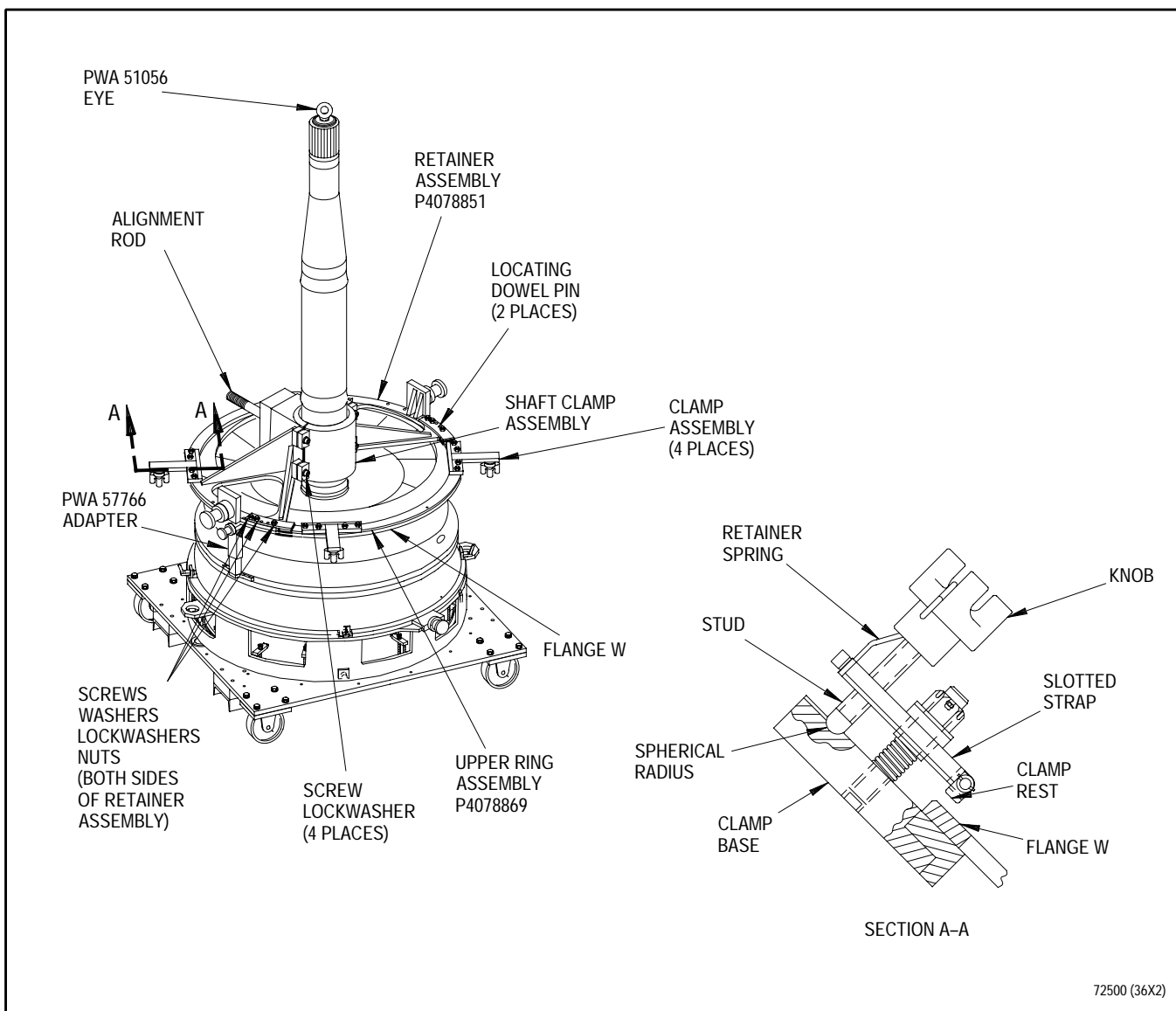


Figure 5. Installation of P4078875 Retainer Assembly onto Fan Drive Turbine Module

- t. Unscrew P4078914 shaft support until shoulder is flush against support plate. If P4078949 stud is installed, unscrew hex nut until washer is flush against support plate. (See figure 6.)
- u. Install plain nut or locknut, depending on configuration, and torque to 325 to 525 pound-inches.
- v. Tighten bar knob to secure retainer assembly and lock with retainer knob.
- w. Release weight and remove PWA 26147 trunnion adapters.

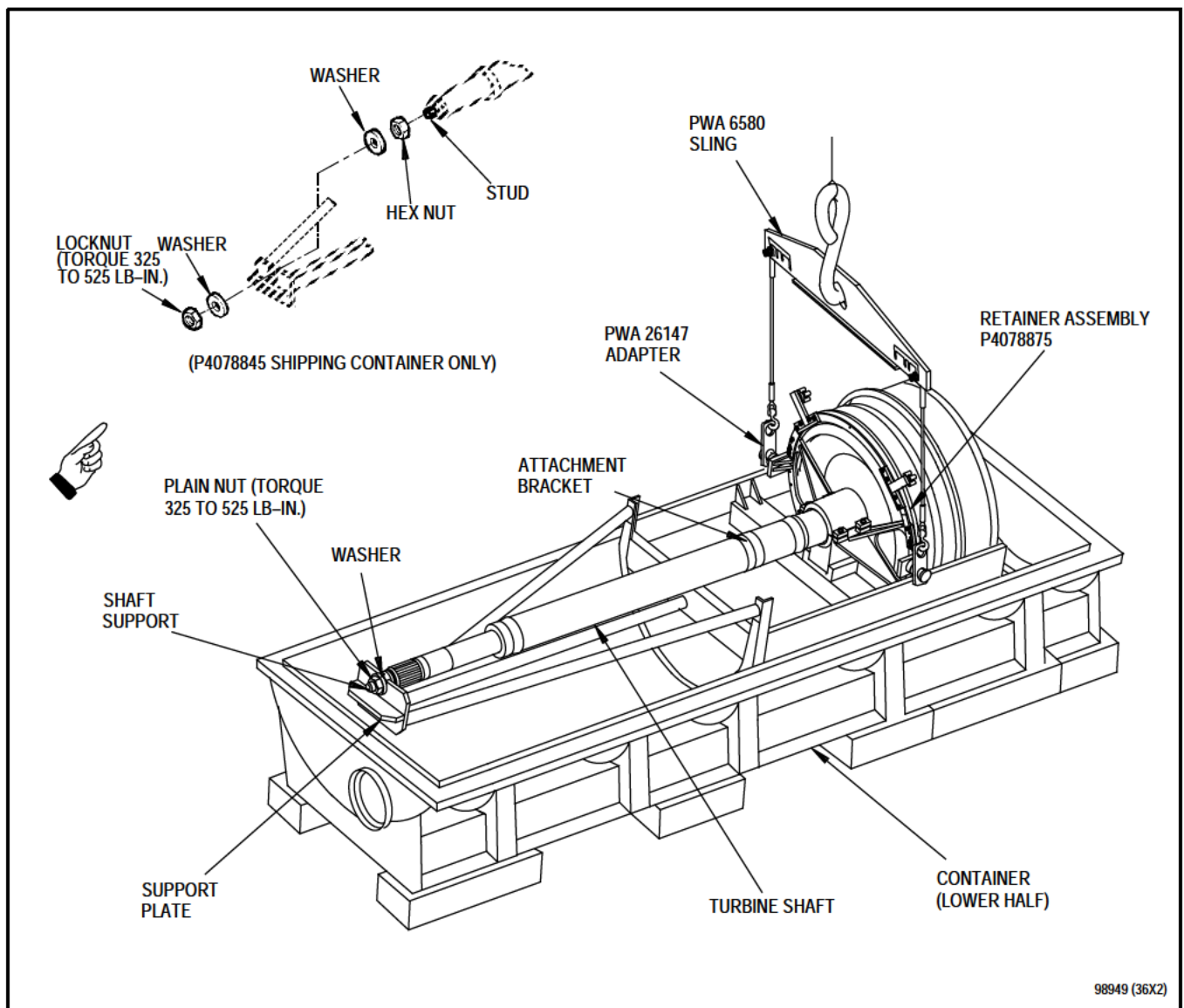


Figure 6. Installation of Fan Drive Turbine Module into Shipping Container

- x. Remove PWA 57824 or PWA 57709 rear retainer from fan drive turbine module as follows:
(See figure 7.)
- (1) Remove PWA 57824 retainer as follows:
 - (a) Loosen knurled nut on shaft several turns.
 - (b) Remove four screws securing handle to No. 5 bearing inner support assembly.
 - (c) Rotate handle several turns counterclockwise on shaft.
 - (d) Unthread shaft from No. 5 bearing plug.
 - (2) Remove PWA 57709 retainer as follows:
 - (a) Unthread handle from shaft.
 - (b) Remove four screws securing base to No. 5 bearing inner support assembly. Remove base from shaft.
 - (c) Unthread shaft from No. 5 bearing plug.
- y. Seal fan drive turbine module shipping container.
(See figure 8.)

NOTE

Packaging items such as desiccant, lockwire, lead seals, etc., are available in PN P4078920 consumable packaging parts.

- z. Place all shipping papers in container record receptacle.
(See figure 8.) Secure record receptacle with bolts, PN MS20995-C41 lockwire and PN 83280 lead seal.

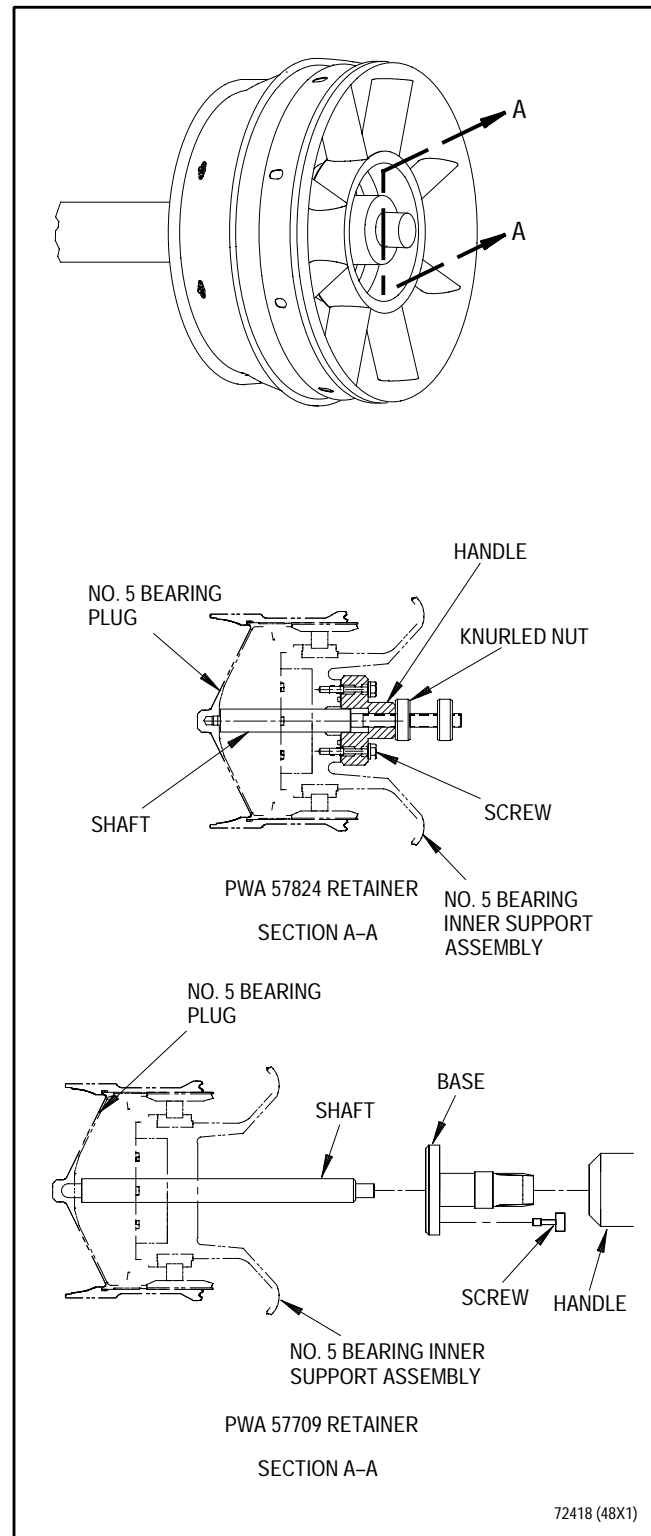


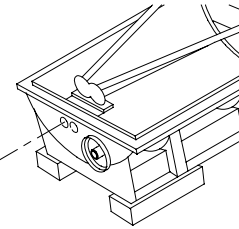
Figure 7. Removal of Rear Retainer



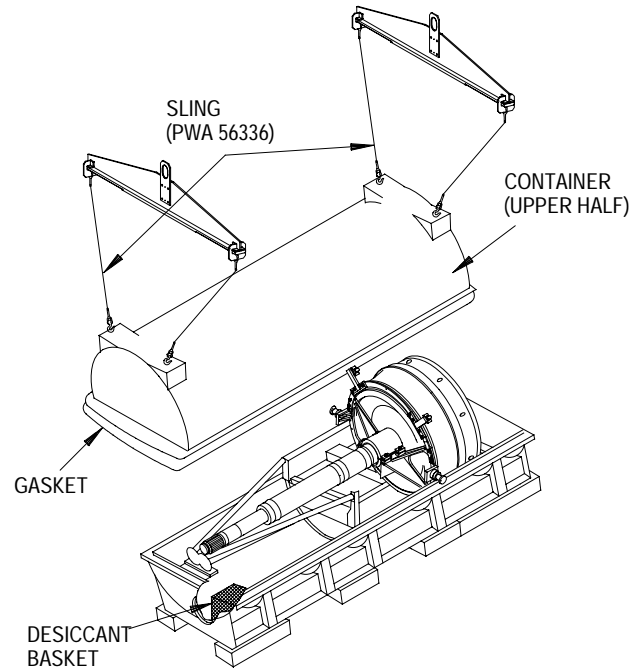
CONCENTRATION OF HEAT MAY DAMAGE
HUMIDITY INDICATOR.

- a. REPLACE HUMIDITY INDICATOR OR RETURN SERVICEABLE INDICATOR TO USEABLE CONDITION BY DRYING, USING HAND HELD DRYER UNTIL BLUE COLOR OR INDICATOR IS RESTORED.

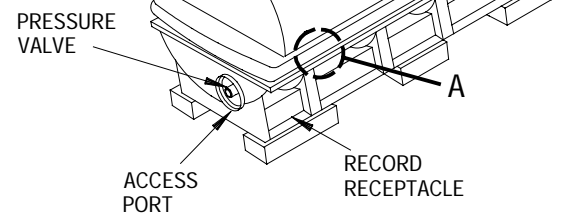
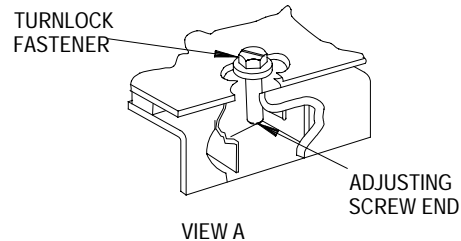
HUMIDITY
INDICATOR



- b. MAKE CERTAIN CONDITION STATUS TAG IS ATTACHED TO MODULE IF REQUIRED.
- c. MAKE CERTAIN CONTAINER UPPER HALF IS CLEAN AND THAT MODULE IS MOUNTED SECURELY IN CONTAINER BOTTOM HALF. PLACE EIGHT BAGS OF P8320 DESICCANT (MIL-D-3464) IN BASKET.
- d. ATTACH SLINGS (PWA 56336) TO CONTAINER UPPER HALF AND INSTALL CONTAINER AND GASKET ON LOWER HALF OF CONTAINER. REMOVE SLINGS



- e. FASTEN COVER IN PLACE BY TURNING TURNLOCK FASTENERS 1/4 TURN CLOCKWISE.



JJ004685 (48X2)

Figure 8. Fan Drive Turbine Module - Sealing Shipping Container

- aa. Install access port packing and cover if not previously installed. Secure with bolts. Torque bolts to 200 pound-inches.
- ab. Lockwire bolts with PN MS20995-C41 wire and PN 83280 lead seal.
- ac. Perform container pneumatic pressure leak test as follows:
 - (1) Remove container 1/8 NPT plug from desiccant access port cover. Through hole introduce supply of air. Test pressure shall be sufficient to overcome pressure relief valve setting.

NOTE

These instructions are for leak testing metal containers only. Fiberglass containers shall be leak tested in accordance with T.O. 35E20-3-33-1.

- (2) After relief valve opens, stop source of air pressure allowing container pressure to drop and relief valve to close. Do not remove source of air pressure.
- (3) Use soap solution to check container flange for leakage. If leakage exists, tighten adjusting screw at turnlock fastener locations. Use 3/16 hex key to a maximum of 100 pound-inches where leaks have been identified.
- (4) Reintroduce air into container and recheck container flange for leaks. If leak persists, repair container as required.

- (5) Remove air source line and install container 1/8 NPT plug.

- ad. After successful completion of leak test, sealed containers can be shipped with no internal pressure.

3. FAN DRIVE TURBINE MODULE - CONTAINER IDENTIFICATION PLATE REPLACEMENT.

- a. Remove damaged identification plate(s) from end of container.
- b. Clean identification plate area with isopropyl alcohol TT-I-735.
- c. Mark each identification plate as follows:

CONTAINER: SHIPPING AND STORAGE,
METAL REUSABLE

FOR PACKING: FAN DRIVE TURBINE
MODULE

SPEC: MIL-C-5584, MFGRS. PART
NO. P4070537

MODEL NO: F100-PW-229

- d. Peel protective backing sheet off identification plate exposing adhesive surface. Do not handle adhesive surface, locate plates on end of container 10 to 12 inches to right of container vertical centerline with horizontal edge one half to one inch from flange surface. Press firmly over complete plate area. This applies to both halves of container.

WORK PACKAGE

INTRODUCTION

FAN DRIVE TURBINE MODULE -

DISASSEMBLY INTO SUBASSEMBLIES

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 2

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2					0

T.O. 2J-F100-53-9

WP 010 00

1. INTRODUCTION.

This work package introduces the 010 00 through 019 00 series for dismantling the fan drive turbine module into subassemblies. The following work packages are included in this series:

WP/SWP No.	Title
011 00	Fan Drive Turbine Module - Installation Into Vertical Build Stand
012 00	Fan Drive Turbine Module - Disassembly Into Subassemblies
013 00 through 019 00	Open

WORK PACKAGE**TECHNICAL PROCEDURES****FAN DRIVE TURBINE MODULE -****INSTALLATION INTO VERTICAL BUILD STAND****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 18

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	27	6B Blank Added	27	10 - 12	27
4 - 5	15	7	27	13	15
6	23	8	15	14	16
6A Added	27	9	23	15 - 16	15

REFERENCE MATERIAL REQUIRED

Title	Number
Propeller and Engine Shaft Wrenches - - - - -	T.O. 32A5-2-2-1
Wrench, Hydraulic, PWA 50308 - - - - -	T.O. 32B14-5-2-1

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T. O. No.	Date	Level	Title (ECP No.)
2J-F100229-554	15 FEB 1995	O/I	Modification of PWA 57704 adapter, F100-PW-229 engines, F-15/F-16 Aircraft (ECP 89QA624-1)

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
PENETRANT, AEROKROIL	NSN 9150-00-905-1387
TAPE, MASKING (PMC 4001)	CC 150-01B RED

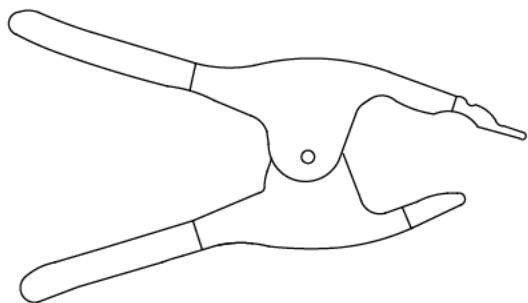
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

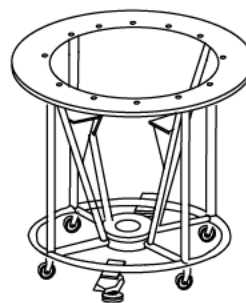
Paragraph	Function - Tool Nomenclature	Tool Number
2	FAN DRIVE TURBINE MODULE - INSTALLATION INTO VERTICAL BUILD STAND	
	ADAPTER, LIFT AND TRUNNION, FAN DRIVE TURBINE MODULE (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57766
	RETAINER, TURBINE FRONT (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57819
		OR
	RETAINER ASSEMBLY - - - - -	PWA 57648
		OR
	RETAINER, FRONT, FAN DRIVE TURBINE MODULE - - - - -	PWA 56682
	HOOK, SAFETY - - - - -	PWA 2388
	SLING, HANDLING - - - - -	PWA 6580
	ADAPTER, LIFT AND TRUNNION (TWO REQUIRED) - - - - -	PWA 26147
	EYE, LIFTING - - - - -	PWA 51056
	STAND, MODULE STORAGE - - - - -	PWA 56338
	RETAINER, FRONT, CORE ENGINE MODULE - - - - -	PWA 56731
		OR
	ADAPTER - - - - -	PWA 50996
	ADAPTER, FDT MODULE TO VERTICAL STAND - - - - -	PWA 57839
		OR
	ADAPTER, FDT MODULE TO STAND SHAFT LIP - - - - -	PWA 57708
		OR
	ADAPTER, FRONT COMPRESSOR DRIVE TURBINE SUPPORT, STAND - - - - -	PWA 51719
	SUPPORT, FRONT COMPRESSOR DRIVE TURBINE - - - - -	PWA 10687
	GUIDE, TURBINE SHAFT WRENCH - - - - -	PWA 51721
	ADAPTER, TORQUE - - - - -	PWA 56671
		OR
	WRENCH, TURBINE SHAFT RETAINING NUT - - - - -	PWA 53340
		OR
	WRENCH, TURBINE SHAFT RETAINING NUT - - - - -	PWA 51720
	ADAPTER, WRENCH - - - - -	PWA 52649
	SLING - - - - -	SWE 81001/81002
	TORQUE MULTIPLIER - - - - -	SWE 8100/8200
	WRENCH, HYDRAULIC - - - - -	PWA 50308
	ADAPTER, FAN DRIVE TURBINE MODULE TO BUILD VERTICAL STAND - - - - -	PWA 57818
		OR
	ADAPTER, FDT MODULE TO VERTICAL STAND - - - - -	PWA 57704
		NSN
	STAND, VERTICAL BUILD - - - - -	4920-00-670-2592
	CLAMP - - - - -	LM 1021

ILLUSTRATED SUPPORT EQUIPMENT



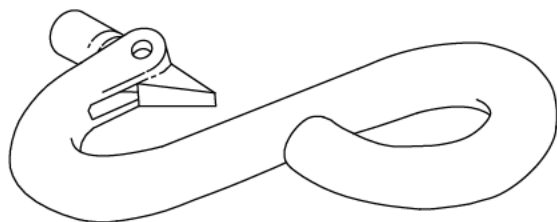
LM 1021 -C

Figure T1. LM 1021 CLAMP



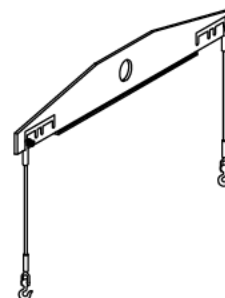
NSN4920-00-670-2592 -C

Figure T2. NSN 4920-00-670-2592 STAND



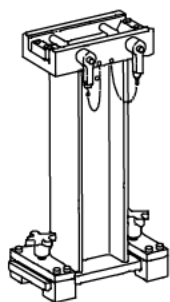
PWA 2388 -C

Figure T3. PWA 2388 HOOK



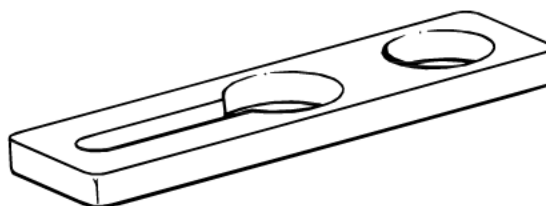
PWA 6580 -C

Figure T4. PWA 6580 SLING



PWA 10687 -C

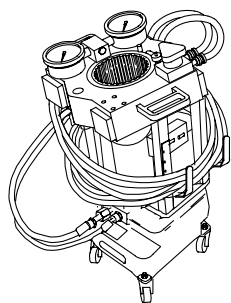
Figure T5. PWA 10687 SUPPORT



PWA 26147 -C

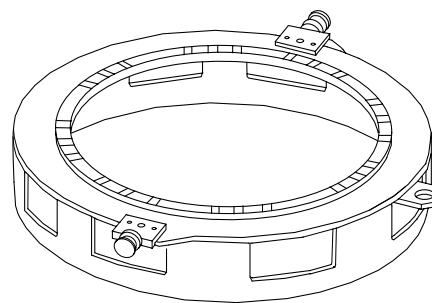
Figure T6. PWA 26147 ADAPTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



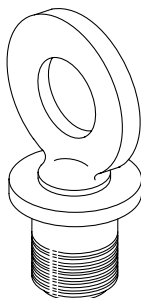
PWA 50308 -C

Figure T7. PWA 50308 WRENCH



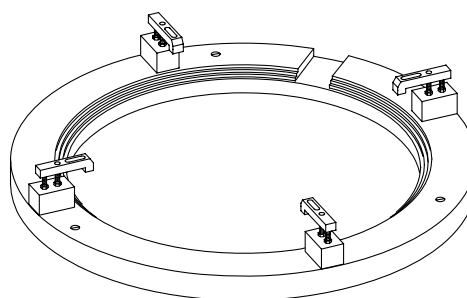
PWA 50996 -C

Figure T8. PWA 50996 ADAPTER



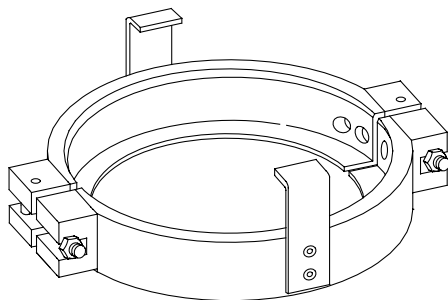
PWA 51056 -C

Figure T9. PWA 51056 EYE



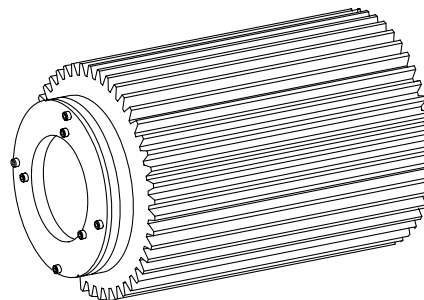
PWA 51719 -C

Figure T10. PWA 51719 ADAPTER



PWA 51721 -C

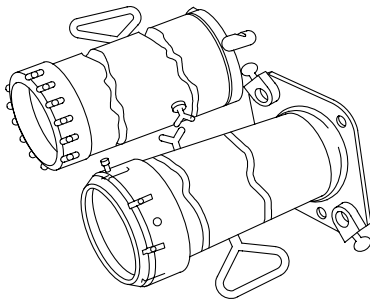
Figure T11. PWA 51721 GUIDE



PWA 52649 -C

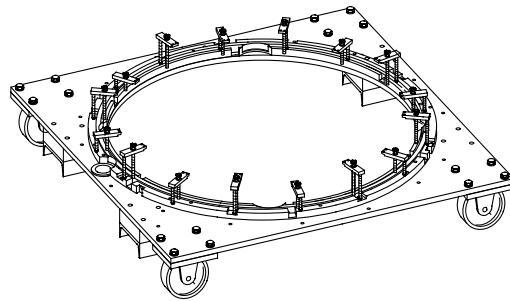
Figure T12. PWA 52649 ADAPTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



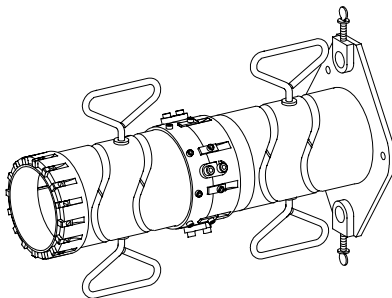
PWA 53340 -C

Figure T13. PWA 53340 WRENCH



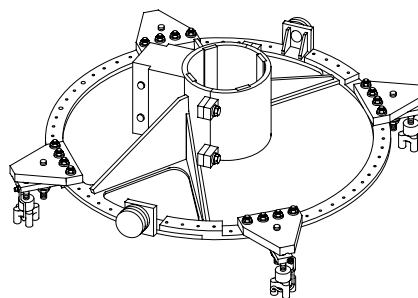
PWA 56338 -C

Figure T14. PWA 56338 STAND



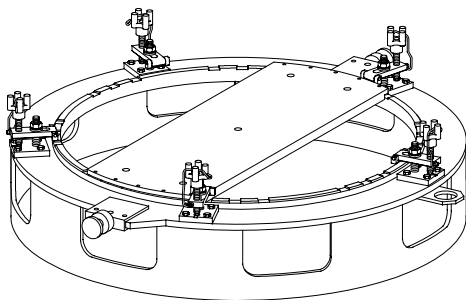
PWA 56671 -C

Figure T15. PWA 56671 ADAPTER



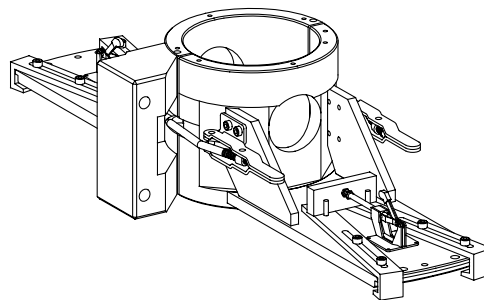
PWA 56682 -C

Figure T16. PWA 56682 RETAINER



PWA 56731 -C

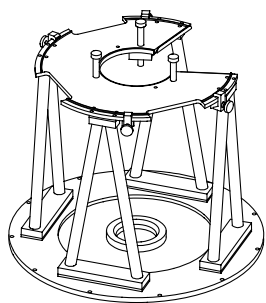
Figure T17. PWA 56731 RETAINER



PWA 57648 -C

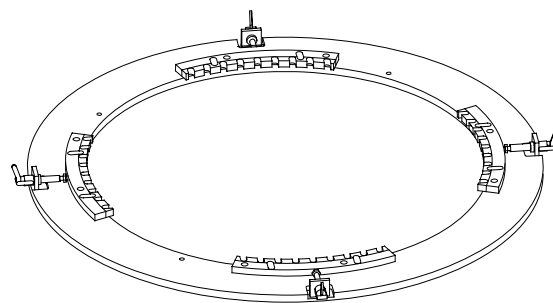
Figure T18. PWA 57648 RETAINER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



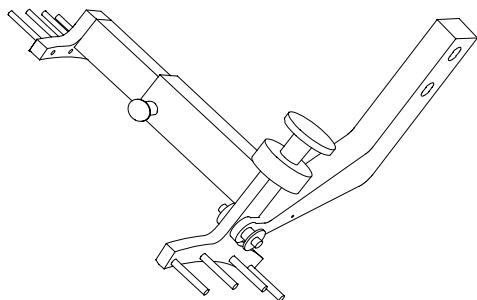
PWA 57704 -C

Figure T19. PWA 57704 ADAPTER



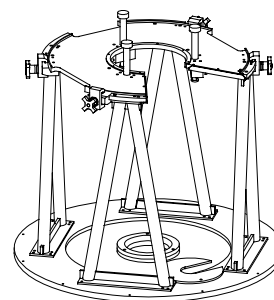
PWA 57708 -C

Figure T20. PWA 57708 ADAPTER



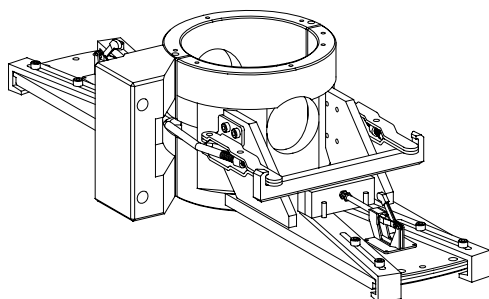
PWA 57766 -C

Figure T21. PWA 57766 ADAPTER



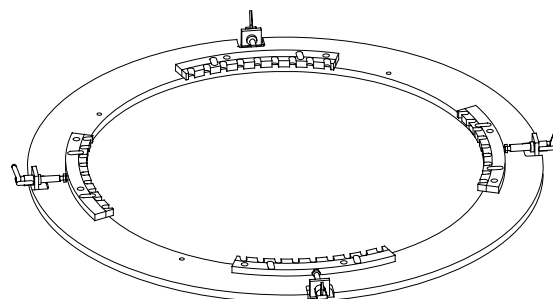
PWA 57818 -C

Figure T22. PWA 57818 ADAPTER



PWA 57819 -C

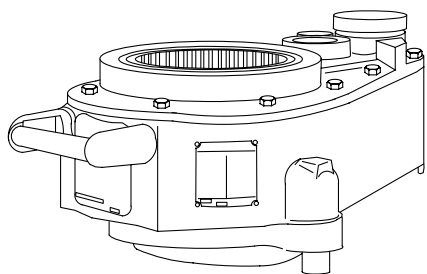
Figure T23. PWA 57819 RETAINER



PWA 57839 -C

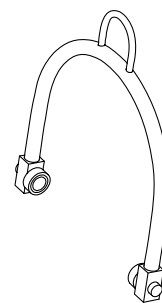
Figure T24. PWA 57839 ADAPTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



SWE 8200 -C

**Figure T25. SWE 8100/8200 TORQUE
MULTIPLIER**



SWE 81002 -C

Figure T26. SWE 81001/81002 SLING

1. INTRODUCTION.

NOTE

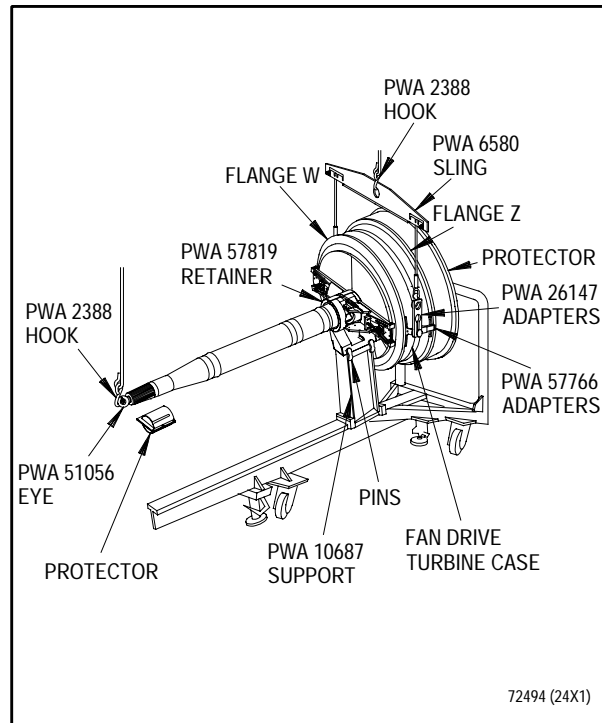
Removal of front compressor driveshaft nut is required prior to module installation into vertical build stand.

- a. This work package contains instructions for installing fan drive turbine module into vertical build stand.

2. FAN DRIVE TURBINE MODULE - INSTALLATION INTO VERTICAL BUILD STAND.

(See Figure 1.)

- a. Install lifting tooling to module as follows:
(See figure 1, Sheet 1.)
 - (1) If necessary, install PWA 57766 adapters between Flange W and Flange Z of fan drive turbine case so that pins of adapter engage holes in outer flange of PWA 57819 retainer.
 - (2) Attach hoist, PWA 2388 hook, PWA 6580 sling, and PWA 26147 adapters to PWA 57766 adapters.
 - (3) Remove protector and thread PWA 51056 eye into front of turbine shaft.
 - (4) Connect hoist, and PWA 2388 hook onto PWA 51056 eye.
 - (5) Remove protector. Ensure PWA 57824 or PWA 57709 retainer is installed and is secure in rear of module.

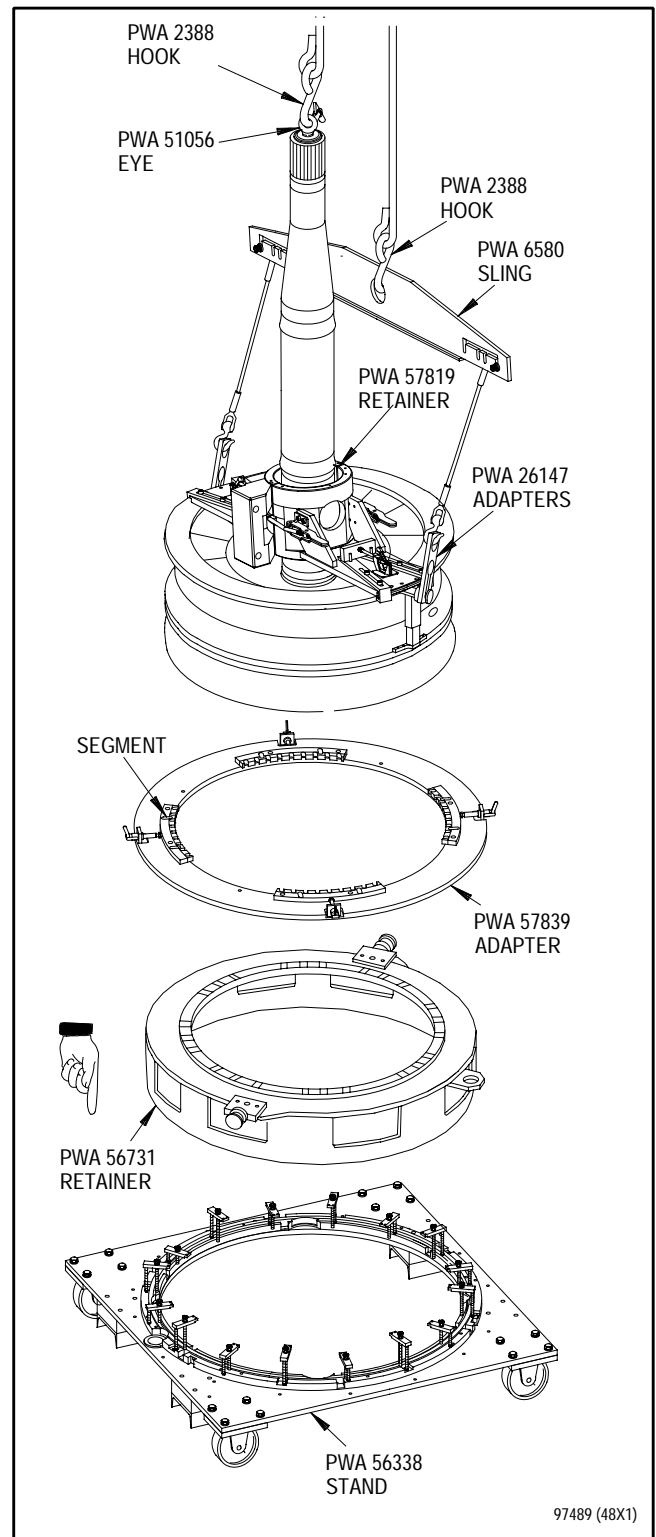


**Figure 1. Fan Drive Turbine Module -
Installation Into Vertical Build Stand
(Sheet 1 of 9)**

b. Rotate turbine module to shaft up position and install into PWA 56338 stand as follows:
(See figure 1, Sheet 2.)

- (1) Ensure that flat side of detail-33 ring on PWA 56338 stand is facing up.
- (2) Install and secure PWA 56731 retainer onto PWA 56338 stand.
- (3) Install and secure PWA 57839 adapter onto PWA 56731 retainer. Ensure seven attaching bolts are secure.
- (4) Remove pins securing PWA 57819 retainer to PWA 10687 support.
- (5) Carefully lift and rotate turbine module to shaft up position and align with stand. Remove PWA 6580 sling and PWA 26147 adapters from PWA 57766 adapters.
- (6) Ensure PWA 57839 adapter detail-2 segments are outward prior to lowering module into stand.
- (7) Slide detail-2 segments inward to support rear side of Flange Z when Flange Z is approximately two inches from top surface of PWA 57839 adapter.
- (8) Carefully lower turbine module into stand and support rear side of Flange Z using PWA 57839 adapter detail-2 segments at four locations.
- (9) If necessary, adjust detail-2 segments threaded rod so segments fit flush against Flange Z.
- (10) Remove PWA 2388 hook, PWA 51056 eye, and PWA 57819 retainer.

- (11) Install protector to front of turbine module.



**Figure 1. Fan Drive Turbine Module - Installation Into Vertical Build Stand
(Sheet 2 of 9)**

NOTE

Second stage turbine support and duct set may be removed from turbine rear case, if desired, without further turbine module disassembly.

- c. Lift support and duct set from rear turbine case. Carefully raise support and duct set upward to clear turbine shaft.
- d. Install tooling for removal of front compressor driveshaft nut as follows: (See figure 1, Sheet 3)
 - (1) Remove retaining ring and key washer.
 - (2) Install PWA 51721 guide at end of PWA 56671 adapter, (split two piece) using lower half only.
 - (3) Install lower half of adapter over turbine shaft down to front compressor driveshaft nut.
 - (4) Remove PWA 51721 guide protector from front of turbine, and engage teeth of PWA 56671 adapter in slots of nut.

WARNING

Failure to cover screws with tape can result in personal injury in case of screw fracture during turbine shaft nut removal.

- (5) If alternate PWA 53340 wrench is to be used, apply CC 150-01B tape to outside diameter to cover eight screws near top end of wrench lower half. Ensure that tape will not interfere with installation of upper half of wrench.

- (6) Install and engage upper half of adapter with lower half. Fasten together by tightening socket head shoulder screws at four C straps.

- (7) Install PWA 52649 adapter on splines at front end of turbine shaft.

NOTE

SWE 81001/81002 sling may be used to handle SWE 8100/8200 torque multiplier.

- (8) Use hoist and carefully seat PWA 50308 hydraulic wrench or SWE 8100/8200 torque multiplier on PWA 52649 adapter with dowels of hydraulic wrench or torque multiplier inserted in holes of PWA 56671 adapter. If torque multiplier is used, attach ratchet adapter and work handle.
- (9) Tighten thumbscrews to fasten wrench and adapter together.

- e. Remove front driveshaft nut as follows:

NOTE

- Splines of PWA 50308 hydraulic wrench or SWE 8100/8200 torque multiplier do not turn. However, force is applied in a clockwise direction.
- Body of hydraulic wrench or torque multiplier moves to turn PWA 56671 adapter in counterclockwise direction.
 - (1) Remove hoist from PWA 50308 hydraulic wrench or SWE 8100/8200 torque multiplier to allow proper operation.

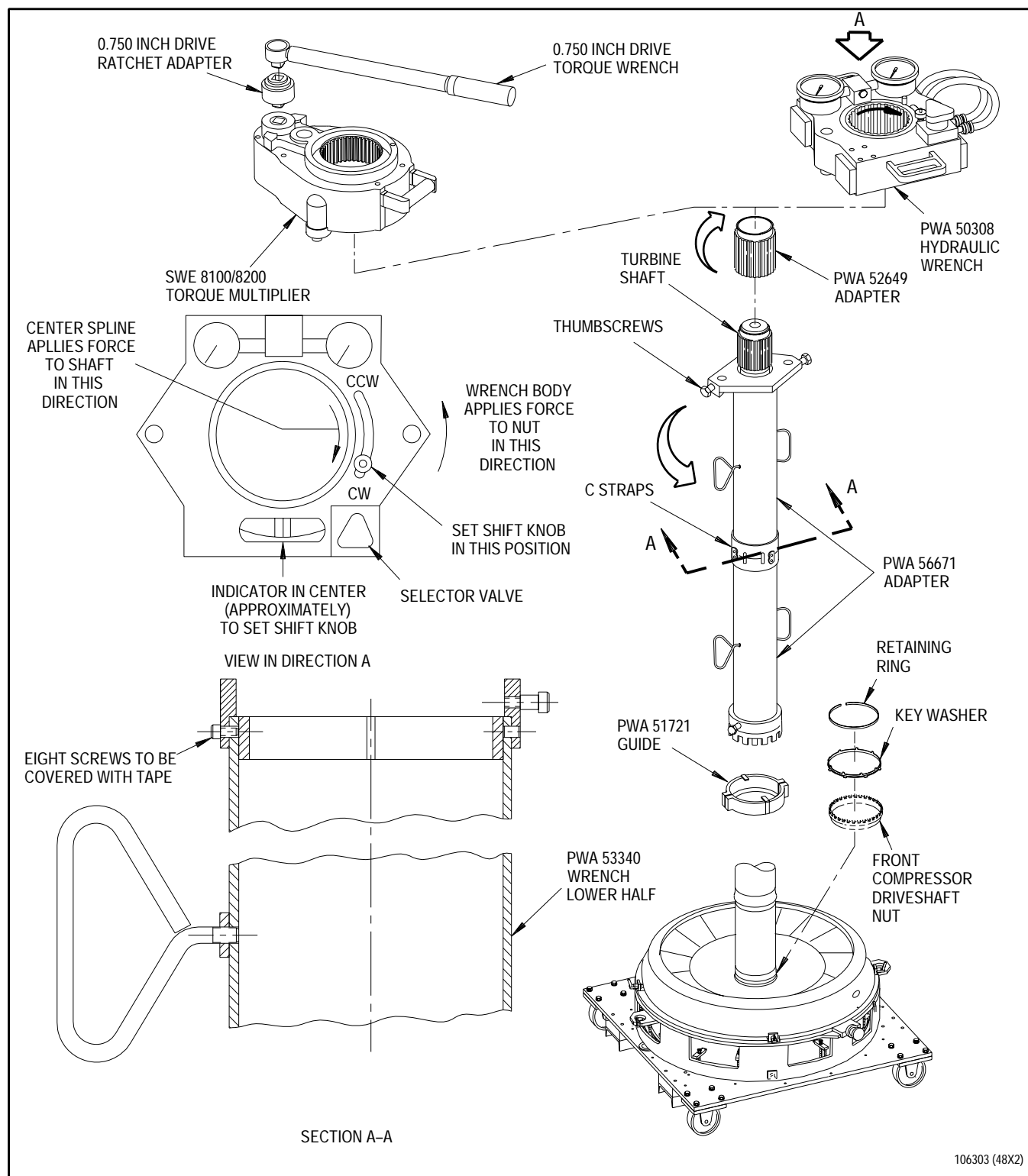


Figure 1. Fan Drive Turbine Module - Installation Into Vertical Build Stand (Sheet 3 of 9)

- (2) If hydraulic wrench is used, set shift knob for clockwise rotation of splines.



Failure to ensure proper rotational direction of hydraulic wrench before use may result in overtorque on retaining nut causing damage to engine components.

NOTE

- Refer to T.O. 32B14-5-2-1 for PWA 50308 hydraulic wrench operating instructions. Refer to T.O. 32A5-2-2-1 for SWE 8100/8200 torque multiplier operating instructions.
 - If penetrant is applied, nut shall be recoated with PWA 36545 antigallant prior to reuse. Refer to WP 401 00.
- (3) Actuate wrench or torque multiplier up to 52,000 pound-inches to loosen nut. If nut does not break loose, soak nut threads and nut/disk interface with Aerokroil penetrant for up to 24 hours. Removal attempts up to 52,000 pound-inches may be repeated any time within 24 hours. After 24 hours, attempt removal with no limit on torque.
- (4) Raise wrench or torque multiplier enough to install guide and remove tooling used to loosen nut.
- (5) Remove front compressor driveshaft nut.

- f. Prepare vertical stand as follows: (See figure 1, Sheet 4.)

- (1) Install PWA 57818 adapter on NSN 4920-00-670-2592 stand. Secure with washers and hex-head capscrews.
- (2) Ensure that three PWA 57704 detail-51 jack assemblies (details of PWA 57818 adapter) are unlocked and spring loaded upward. Loosen detail-7 knurled head screws to unlock detail-51 jack assemblies.

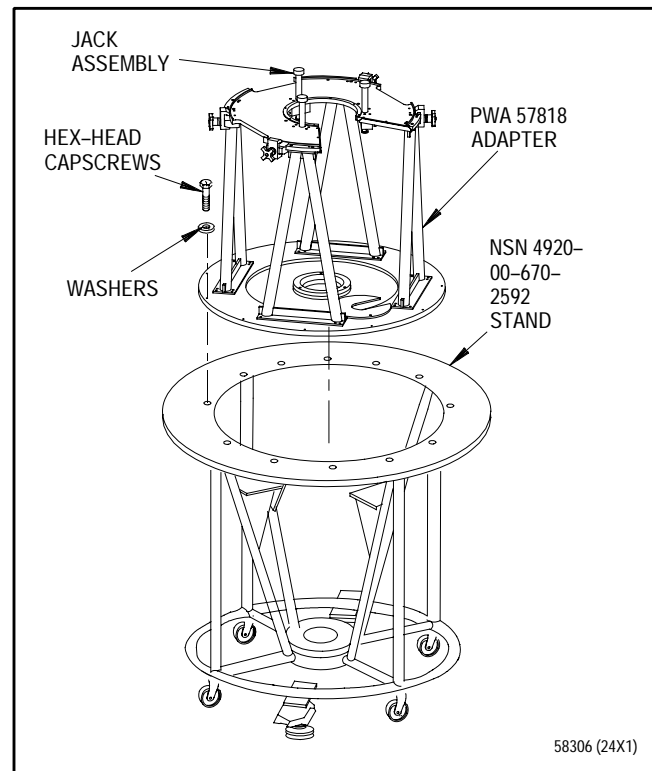
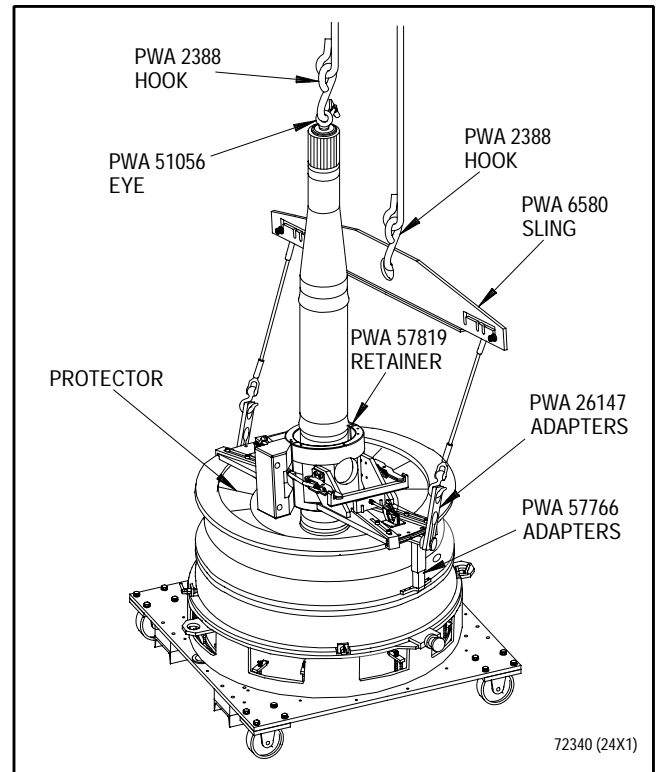


Figure 1. Fan Drive Turbine Module - Installation Into Vertical Build Stand (Sheet 4 of 9)

g. Install lifting tooling to module as follows:
(See figure 1, Sheet 5.)

- (1) Install PWA 57819 retainer to front flange of turbine case so that holes in flange of retainer engage PWA 57766 adapter pins. Ensure PWA 57819 detail-17 pusher lock tabs engage shaft clamp toggle handles.
- (2) Attach hoist, PWA 2388 hook, PWA 6580 sling, and PWA 26147 adapters to PWA 57766 adapters.
- (3) Thread PWA 51056 eye into front of turbine shaft.
- (4) Remove protector from front of turbine.
- (5) Connect hoist and PWA 2388 hook onto PWA 51056 eye.



**Figure 1. Fan Drive Turbine Module -
Installation Into Vertical Build Stand
(Sheet 5 of 9)**

h. Rotate turbine module to shaft down position as follows:
(See figure 1, Sheet 2.)

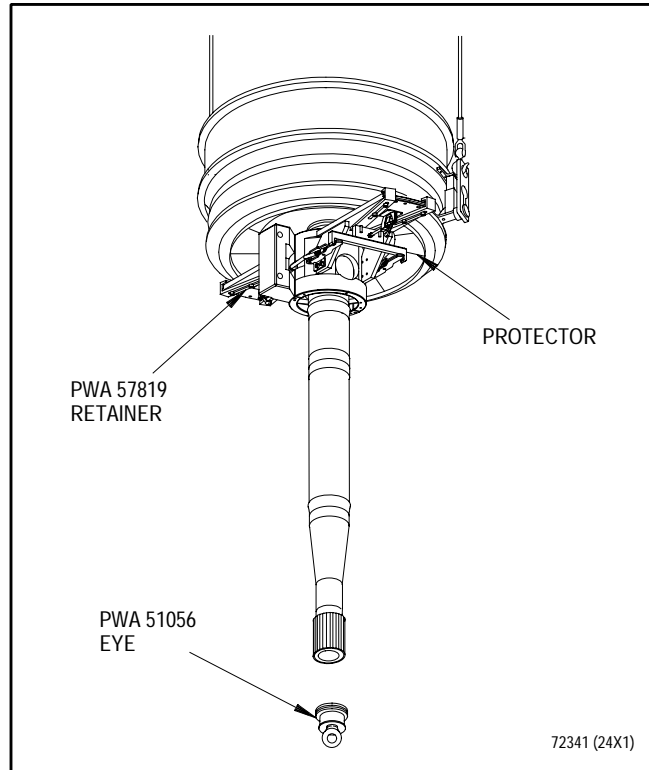
(1) Retract PWA 57839 adapter detail-2 segments at four locations; then carefully lift and rotate turbine module to shaft down position.

i. Install turbine module into vertical stand as follows:
(See figure 1, Sheet 7.)

NOTE

Vertical build stands equipped with alignment collar must be removed prior to turbine module installation.

(1) Align turbine module with center of vertical stand and carefully lower until turbine front flange is within one foot of stand.



**Figure 1. Fan Drive Turbine Module -
Installation Into Vertical Build Stand
(Sheet 6 of 9)**



Second stage turbine support and duct set is loose fit inside rear turbine case and will be damaged if allowed to fall from case during handling.

- (2) Install two LM 1021 clamps 180 degrees apart on forward case flange to hold second stage turbine support and duct set in place.
- (3) Remove PWA 57819 retainer. Align pins of PWA 57766 adapters with slots in stand and carefully lower turbine until front flange is seated on stand. Remove LM 1021 clamps before front flange is fully seated.
- (4) Install protector to rear of module.
- (5) Remove PWA 26147 adapters, PWA 6580 sling, and PWA 57766 adapters.
- (6) Secure turbine module to PWA 57818 adapter with PWA 57704 detail-44 clamps (details of PWA 57818 adapter). Secure clamps with hand knobs.
- (7) Back off PWA 51056 lifting eye to install PWA 57704 detail-46 C washer (detail of PWA 57818 adapter).
- (8) Tighten lifting eye to secure C washer.
- (9) Ensure PWA 57704 detail-51 jack assemblies contact 3rd stage disk assembly. If necessary, lightly load detail-51 jack assemblies against 3rd stage disk assembly to hold position. Secure by tightening detail-7 knurled-head screws. (See figure 1, Sheet 8.)

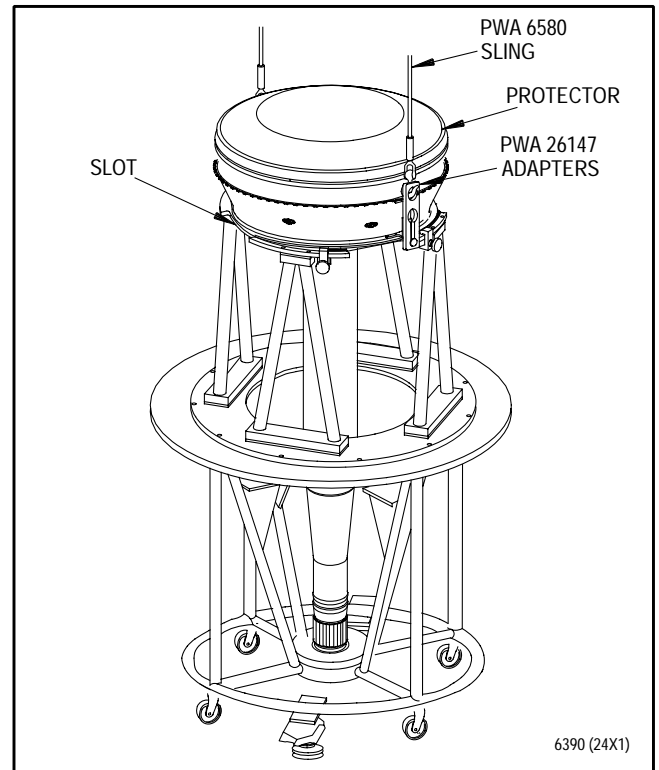


Figure 1. Fan Drive Turbine Module - Installation Into Vertical Build Stand (Sheet 7 of 9)

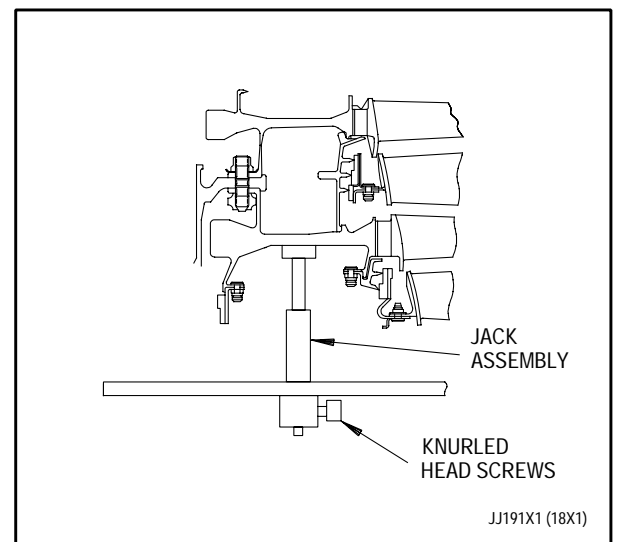


Figure 1. Fan Drive Turbine Module - Installation Into Vertical Build Stand (Sheet 8 of 9)

CAUTION

Failure to ensure that rotor is properly supported before removing rear retainer can lead to parts damage.

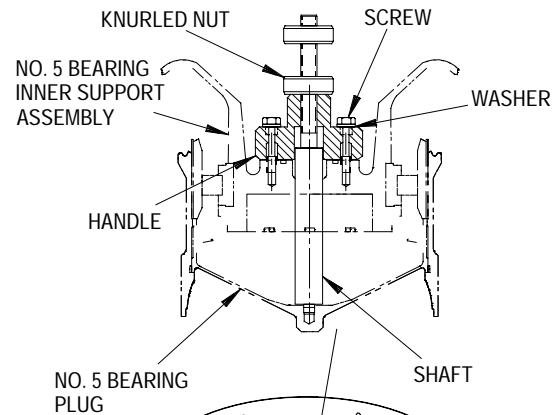
j. Remove PWA 57824 or PWA 57709 rear retainer as follows:
(See figure 1, Sheet 9.)

(1) Remove PWA 57824 retainer as follows:

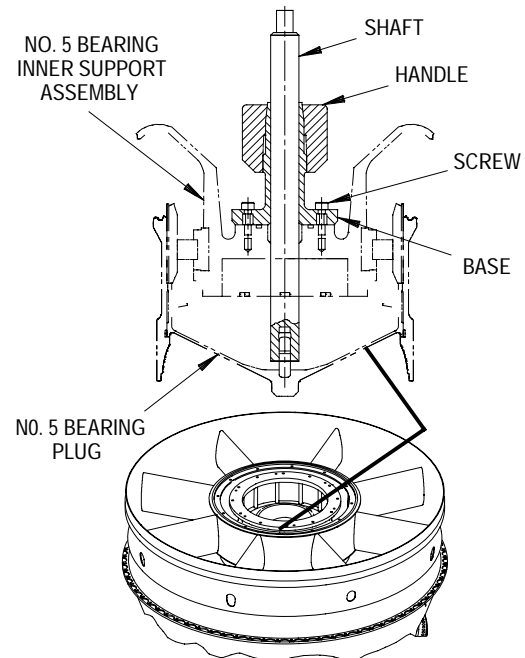
- (a) Loosen knurled nut on shaft several turns.
- (b) Remove four screws securing handle to No. 5 bearing inner support assembly.
- (c) Rotate handle several turns counterclockwise on shaft.
- (d) Unthread shaft from No. 5 bearing plug.

(2) Remove PWA 57709 retainer as follows:

- (a) Unthread handle from shaft.
- (b) Remove four screws securing base to No. 5 bearing inner support assembly and remove base from shaft..
- (c) Unthread shaft from No. 5 bearing plug.



PWA 57824 RETAINER



PWA 57709 RETAINER

72369 (48X1)

**Figure 1. Fan Drive Turbine Module -
Installation Into Vertical Build Stand
(Sheet 9 of 9)**

WORK PACKAGE**TECHNICAL PROCEDURES****FAN DRIVE TURBINE MODULE -****DISASSEMBLY INTO SUBASSEMBLIES****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 20

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	6 - 7	0	12B Added	27
2 - 4A	27	8	28	13	27
4B Blank Added	23	9 - 12	27	14 - 15	18
5	27	12A	11	16	23

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Propeller and Engine Shaft Wrenches - - - - -	T.O. 32A5-2-2-1
Wrench, Hydraulic, PWA 50308 - - - - -	T.O. 32B14-5-2-1

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Oil, lubricating	MIL-L-7808
Pencil (crayon), silver, metal marking (hard)	Colorbrite No. 2101 or Color-Tex No. 1843 or Anadel No. 1936

EXPENDABLE ITEMS

None

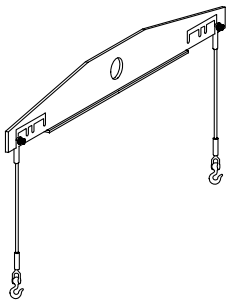
APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
3	NO. 5 BEARING INNER SUPPORT ASSEMBLY - REMOVAL	
	PUSHER/PULLER, NO. 5 INNER BEARING (PART OF PWA 57883 TOOL SET) - - - - -	PWA 57879 OR
	PUSHER/PULLER, NO. 5 INNER BEARING (PART OF PWA 57658 TOOL SET) - - - - -	PWA 57717
4	NO. 5 BEARING SEAL SEAT RETAINING NUT - REMOVAL	
	WRENCH, NO. 5 BEARING SEAL SEAT RETAINING NUT - - - -	PWA 53360
	ADAPTER, NO. 5 BEARING SEAL SEAT RETAINING NUT - - -	PWA 56689 OR
	ADAPTER, NO. 5 BEARING SEAL SEAT RETAINING NUT - - -	PWA 53361
	SLING - - - - -	SWE 81001/81002
	TORQUE MULTIPLIER - - - - -	SWE 8100/8200
	WRENCH, HYDRAULIC - - - - -	PWA 50308
5	NO. 5 BEARING SEAL SEAT - REMOVAL	
	PULLER, NO. 5 BEARING SEAL SEAT - - - - -	PWA 51996
	PROTECTOR, NO. 5 BEARING CARBON SEAL - - - - -	PWA 57800

APPLICABLE SUPPORT EQUIPMENT (continued)

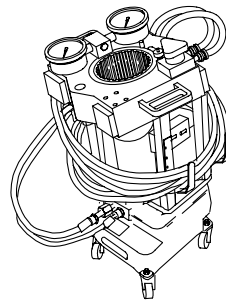
Paragraph	Function - Tool Nomenclature	Tool Number
6	NO. 5 BEARING OUTER RACE RETAINING NUT - REMOVAL	
	HOLDER, NO. 5 BEARING OUTER RACE RETAINING NUT - - -	PWA 51960
	WRENCH, NO. 5 BEARING OUTER RACE RETAINING NUT - - -	PWA 51959
	SLING - - - - -	SWE 81001/81002
	TORQUE MULTIPLIER - - - - -	SWE 8100/8200
	WRENCH, HYDRAULIC - - - - -	PWA 50308
	PROTECTOR, NO. 5 BEARING CARBON SEAL - - - - -	PWA 57800
7	NO. 5 BEARING OUTER RACE - REMOVAL USING PWA 51010 OR PWA 53878 PULLERS	
	PULLER, NO. 5 BEARING OUTER RACE - - - - -	PWA 51010
		OR
	PULLER, NO. 5 BEARING OUTER RACE - - - - -	PWA 53878
	PUMP, HYDRAULIC - - - - -	PWA 55380
7A	No. 5 BEARING OUTER RACE - REMOVAL USING PWA 57483 PULLER	
	PULLER, NO. 5 BEARING OUTER RACE - - - - -	PWA 57483
	PUMP, HYDRAULIC - - - - -	PWA 55380
8	TURBINE EXHAUST CASE ASSEMBLY - REMOVAL	
	STRAP, WEBBED (TWO REQUIRED) - - - - -	
		OR
	SLING, HANDLING - - - - -	PWA 6580

ILLUSTRATED SUPPORT EQUIPMENT



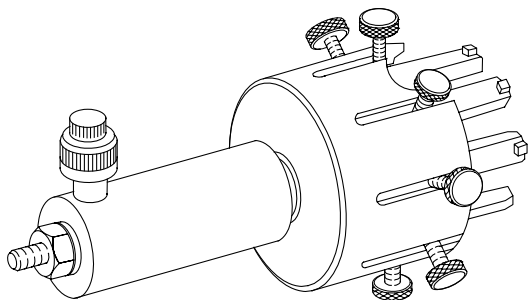
PWA 6580 -C

Figure T1. PWA 6580 SLING



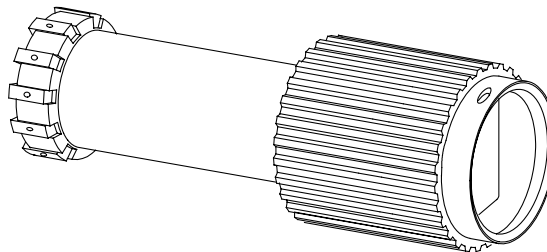
PWA 50308 -C

Figure T2. PWA 50308 WRENCH



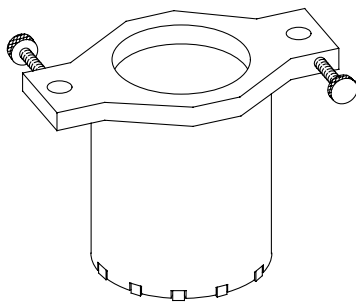
PWA 51010 -C

Figure T3. PWA 51010 PULLER



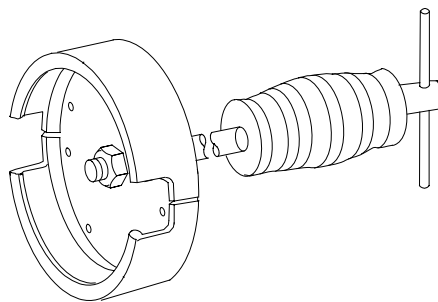
PWA 51959 -C

Figure T4. PWA 51959 WRENCH



PWA 51960 -C

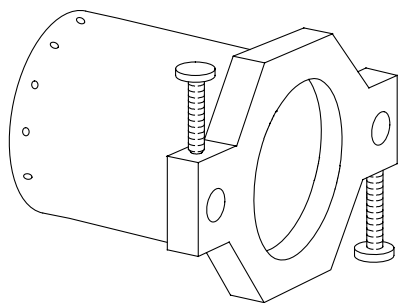
Figure T5. PWA 51960 HOLDER



PWA 51996 -C

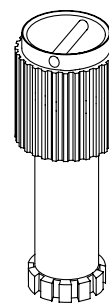
Figure T6. PWA 51996 PULLER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



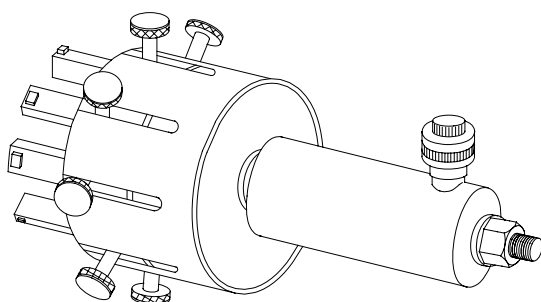
PWA 53360 -C

Figure T7. PWA 53360 WRENCH



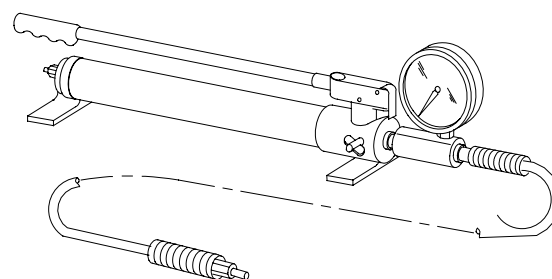
PWA 53361 -C

Figure T8. PWA 53361 ADAPTER



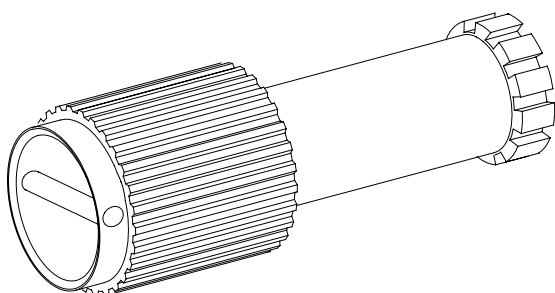
PWA 53878 -C

Figure T9. PWA 53878 PULLER



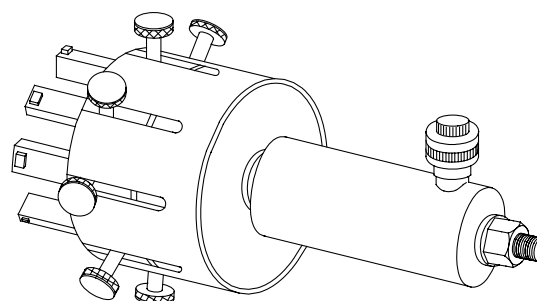
PWA 55380 -C

Figure T10. PWA 55380 PUMP



PWA 56689 -C

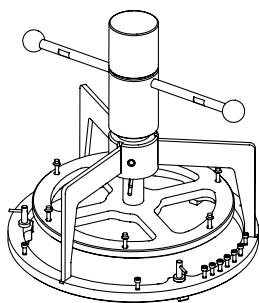
Figure T11. PWA 56689 ADAPTER



PWA 57483 -C

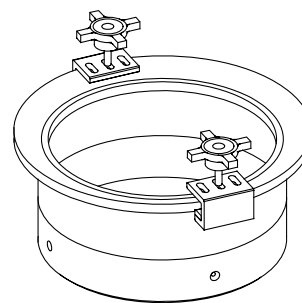
Figure T12. PWA 57483 PULLER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



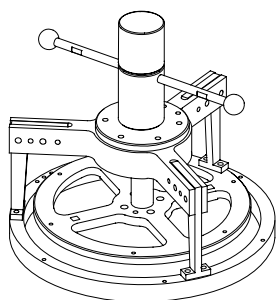
PWA 57717 -C

Figure T13. PWA 57717 PUSHER/PULLER



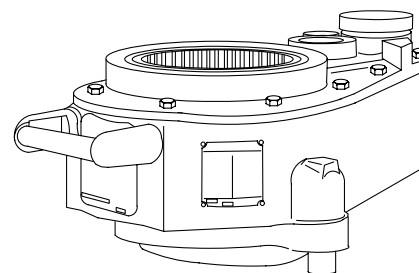
PWA 57800 -C

Figure T14. PWA 57800 PROTECTOR



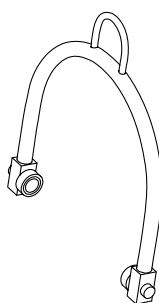
PWA 57879 -C

Figure T15. PWA 57879 PUSHER/PULLER



SWE 8200 -C

Figure T16. SWE 8100/8200 TORQUE MULTIPLIER



SWE 81002 -C

Figure T17. SWE 81001/81002 SLING

1. INTRODUCTION.

a. This work package contains instructions for disassembling fan drive turbine module. The following parts are removed:

- No. 5 bearing inner support assembly and No. 5 bearing inner race and rollers
- No. 5 bearing seal seat
- No. 5 bearing outer race
- Turbine exhaust case assembly

2. PRELIMINARY INSTRUCTIONS.

a. If necessary, install fan drive turbine module in vertical build stand. Refer to
T.O. 2J-F100-53-9, WP 011 00.

3. NO. 5 BEARING INNER SUPPORT ASSEMBLY - REMOVAL.

(See Figure 1, Sheet 1 of 3.)

NOTE

5 bearing inner support assembly and No. 5 bearing inner race and rollers are removed as an assembly.

- a. If installed, remove protector from rear flange of turbine exhaust case. (See figure 1, Sheet 1.)
- b. Mark No. 5 bearing inner support assembly, No. 5 bearing seal assembly, and turbine exhaust case at 12 o'clock position using Colorbrite No. 2101 silver pencil or equivalent. 12 o'clock position is located on center line of first hole counterclockwise from dowel pin in Flange W.
- bl. Remove nuts and bolts securing No. 5 bearing inner support assembly to No. 5 bearing seal assembly.

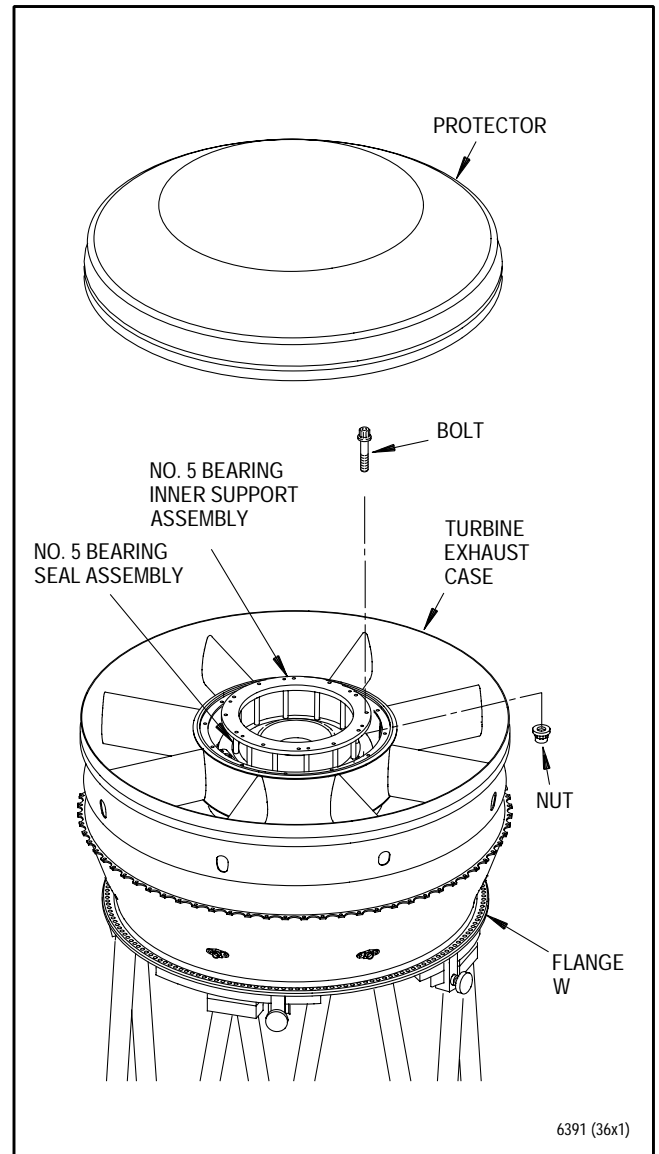


Figure 1. No. 5 Bearing Inner Support Assembly - Removal (Sheet 1 of 3)

c. Unseat inner support as follows:

- (1) Remove six detail-13 screws from PWA 57879 pusher/puller area marked STORAGE.
- (2) Thread detail-13 screws into six holes at outer flange of inner support, fingertight. Gradually tighten screws one at a time in a staggered sequence until snap is overcome.
- (3) Remove detail-13 screws from outer flange and store in holes of PWA 57879 pusher/puller marked STORAGE.

d. Install PWA 57879 pusher/puller to inner support as follows:

NOTE

Adjustment of handle may be required to align holes.

- (1) Install pusher/puller over inner support aligning first threaded hole clockwise from TDC on inner support assembly with hole marked TOP on base of pusher/puller.
- (2) Tighten detail-23 screws until base is seated.
- (3) Adjust pusher/puller over turbine case ID flange aligning hole marked TOP on ring with TDC position of case flange.
- (4) Tighten detail-22 screws until pusher/puller ring is fully seated.

e. Remove inner support from bearing seal assembly by turning handle slowly counterclockwise the full length of travel.

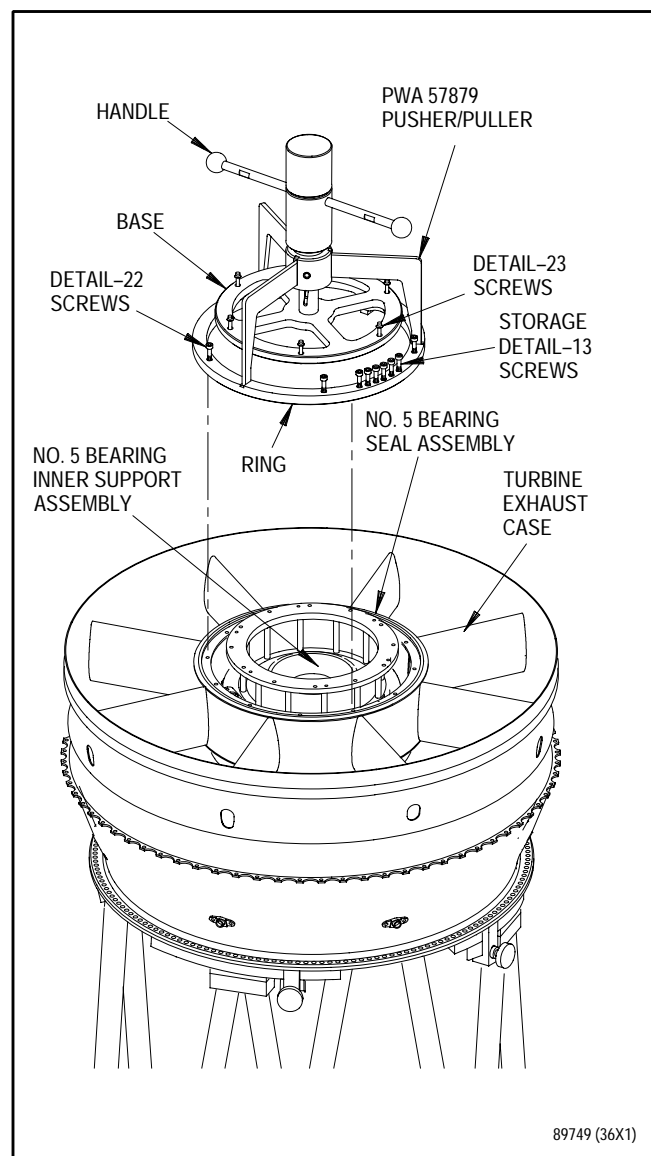
f. Loosen six detail-22 screws from turbine exhaust case.

WARNING

Do not place fingers under pusher/puller. No. 5 bearing can get hung up on shaft during assembly and removal and become falling hazard during tool removal.

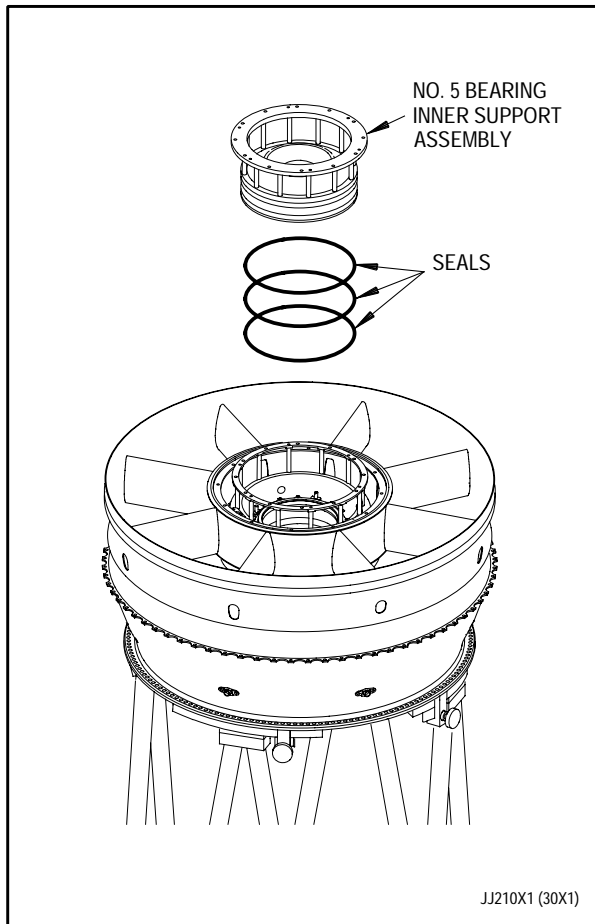
g. Lift PWA 57879 pusher/puller and inner support from turbine exhaust case and place on bench.

h. Remove pusher/puller.



89749 (36X1)

**Figure 1. No. 5 Bearing Inner Support Assembly
- Removal (Sheet 2 of 3)**



**Figure 1. No. 5 Bearing Inner Support Assembly
- Removal (Sheet 3 of 3)**

- i. Remove No. 5 bearing inner support assembly wearing protective gloves. (See figure 1, Sheet 3.) Carefully handle No. 5 bearing inner support assembly to prevent separation of inner race and rollers.

NOTE

No. 5 bearing inner support assembly plain seal consists of a teflon spring loaded seal and metal backup ring. Aft most plain seal does not contain a metal backup ring.

- j. Carefully remove seals and discard.
- k. Cap and store No. 5 bearing support assembly in protective container.

4. NO. 5 BEARING SEAL SEAT RETAINING NUT - REMOVAL. (See Figure 2.)

NOTE

There are two configurations No. 5 bearing roller guide:

- One incorporating locking tabs and used with a retaining ring.
 - One not incorporating locking tabs and used with a key washer.
- a. Remove No. 5 bearing roller guide as follows: (See figure 2, Sheet 1.)
 - (1) For assemblies incorporating roller guide with locking tabs, remove retaining ring and roller guide.
 - (2) For assemblies incorporating roller guide without locking tabs, remove roller guide and key washer.
 - b. Install PWA 53360 wrench ensuring that lugs at bottom of wrench engage slots in No. 5 bearing seal seat retaining nut.
 - c. Install PWA 56689 adapter ensuring that lugs at bottom of adapter engage slots in turbine shaft.

NOTE

SWE 81001/81002 sling may be used to handle SWE 8100/8200 torque multiplier.

- d. Use hoist to install PWA 50308 hydraulic wrench or SWE 8100/8200 torque multiplier aligning splines of PWA 56689 adapter. Engage dowel pins on body of hydraulic wrench or or torque multiplier with holes at top of PWA 53360 wrench. Secure by tightening thumb screws. If torque multiplier is used, attach ratchet adapter and work handle. Remove hoist from PWA 50308 hydraulic wrench or SWE 8100/8200 torque multiplier.

NOTE

- Body of hydraulic wrench or torque multiplier moves to turn PWA 53360 wrench in a counterclockwise direction.
 - Splines of hydraulic wrench or torque multiplier do not turn. However, force is applied in a clockwise direction.
 - PWA 56689 adapter does not turn. However, force is applied in a counterclockwise direction.
- e. If hydraulic wrench is used, set shift knob for clockwise spline rotation. (See figure 2, Sheet 2.)

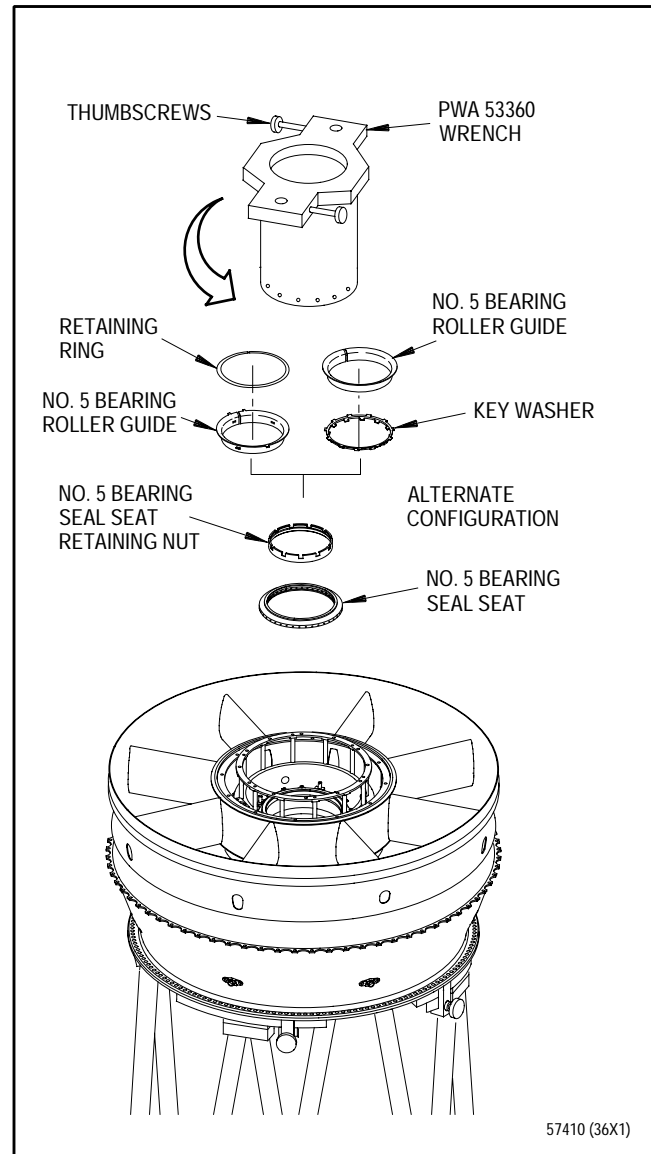


Figure 2. No. 5 Bearing Seal Seat Retaining Nut - Removal (Sheet 1 of 2)

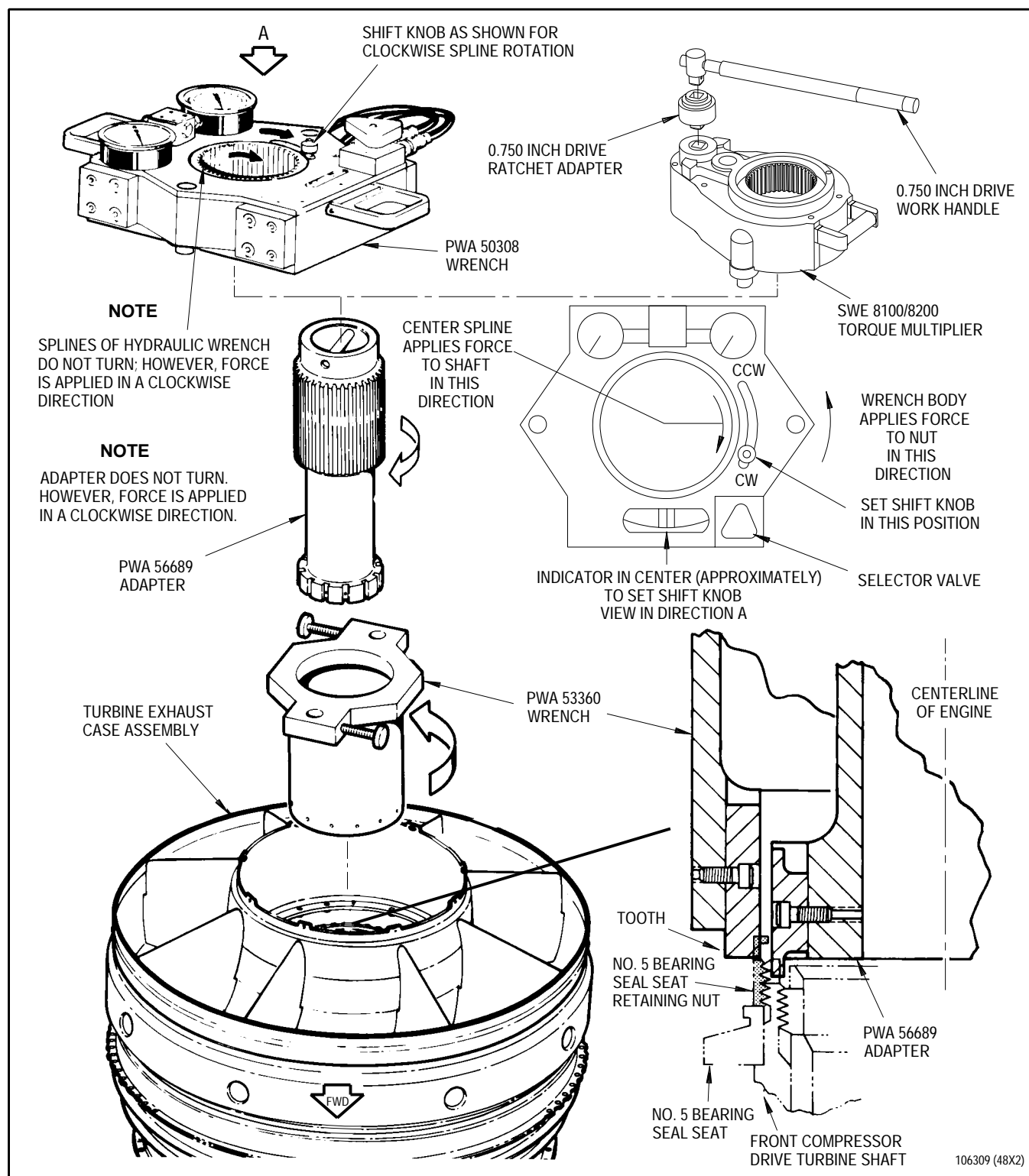


Figure 2. No. 5 Bearing Seal Seat Retaining Nut - Removal (Sheet 2 of 2)



Failure to ensure proper rotational direction of hydraulic wrench before use may result in over torque on retaining nut causing damage to engine components.

NOTE

Refer to T.O. 32B14-5-2-1 for PWA 50308 hydraulic wrench operating instructions. Refer to T.O. 32A5-2-2-1 for SWE 8100/8200 torque multiplier operating instructions.

- f. Actuate wrench or torque multiplier to loosen No. 5 bearing seal seat retaining nut.
- g. Remove tooling used to loosen retaining nut. Remove retaining nut.

5. NO. 5 BEARING SEAL SEAT - REMOVAL.

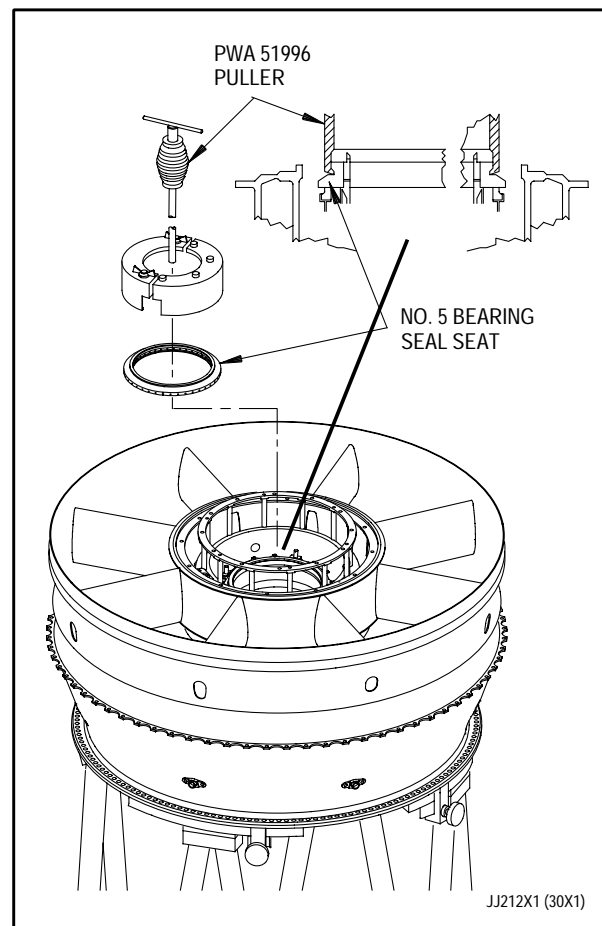
(See Figure 3.)

NOTE

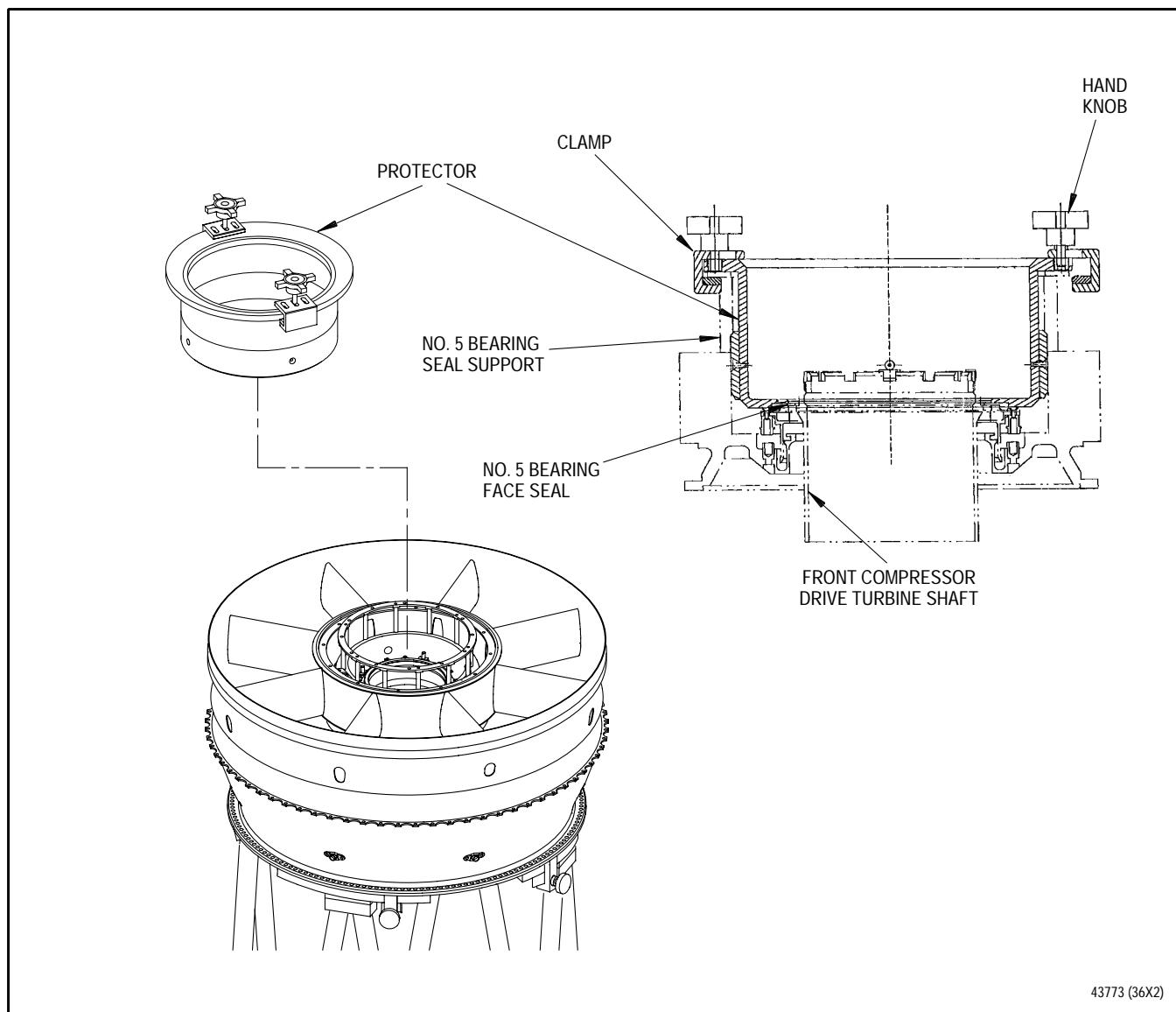
Usually the No. 5 bearing seal seat can be removed by hand. If seal seat is hard to remove, use PWA 51996 puller as follows:

- a. Loosen wing nuts of PWA 51996 puller so that jaws slide outward.
- b. Install puller on No. 5 bearing seal seat. Slide jaws in, ensuring that they fit in puller groove of seal seat. Secure jaws by tightening wing nuts.
- c. Work knocker hammer of puller to remove seal seat.
- d. Remove tooling and store seal seat in protective container.
- e. Install PWA 57800 No. 5 bearing seal protector as follows: (See figure 3, sheet 2.)

- (1) Secure clamps in outboard position using hand knobs.
- (2) Align four slots in base of protector with four carbon seal guide pins.
- (3) Carefully insert protector into seal support until protector flange contacts support rear flange.
- (4) Hold protector against support flange and secure flange clamps in inboard position using hand knobs.



**Figure 3. No. 5 Bearing Seal Seat - Removal
(Sheet 1 of 2)**



43773 (36X2)

Figure 3. No. 5 Bearing Seal Seat - Removal (Sheet 2 of 2)

6. NO. 5 BEARING OUTER RACE RETAINING NUT - REMOVAL.

(See Figure 4.)

- a. Remove No. 5 bearing outer race retaining nut as follows:

- (1) Install PWA 51960 holder ensuring lugs engage slots of turbine shaft.
- (2) Install PWA 51959 wrench ensuring lugs at bottom engage slots in No. 5 bearing outer race retaining nut.

NOTE

SWE 81001/81002 sling may be used to handle SWE 8100/8200 torque multiplier.

- (3) Use hoist to install PWA 50308 hydraulic wrench or SWE 8100/8200 torque multiplier aligning with splines of adapter. Engage dowel pins on body of hydraulic wrench or torque multiplier with holes at top of PWA 51960 holder. Secure by tightening thumb screws. If torque multiplier is used, attach ratchet adapter and work handle. Remove hoist from PWA 50308 hydraulic wrench or SWE 8100/8200 torque multiplier.
- (4) If hydraulic wrench is used, set shift knob for clockwise spline rotation.



Failure to ensure proper rotational direction of hydraulic wrench before use may result in over torque on retaining nut causing damage to engine components.

NOTE

- Hold body of hydraulic wrench or SWE 8100/8200 torque multiplier so that nut will turn. Turbine shaft will turn if body of wrench is not held.
 - Refer to T.O. 32B14-5-2-1 for PWA 50308 hydraulic wrench operating instructions. Refer to T.O. 32A5-2-2-1 for SWE 8100/8200 torque multiplier operating instructions.
- (5) Actuate wrench or torque multiplier to loosen No. 5 bearing outer race retaining nut.
 - (6) Remove tooling used to loosen retaining nut. Remove retaining nut.
- b. Remove PWA 57800 protector as follows:
- (1) Secure flange clamps in outboard position using hand knobs.
 - (2) Carefully remove protector from seal support.

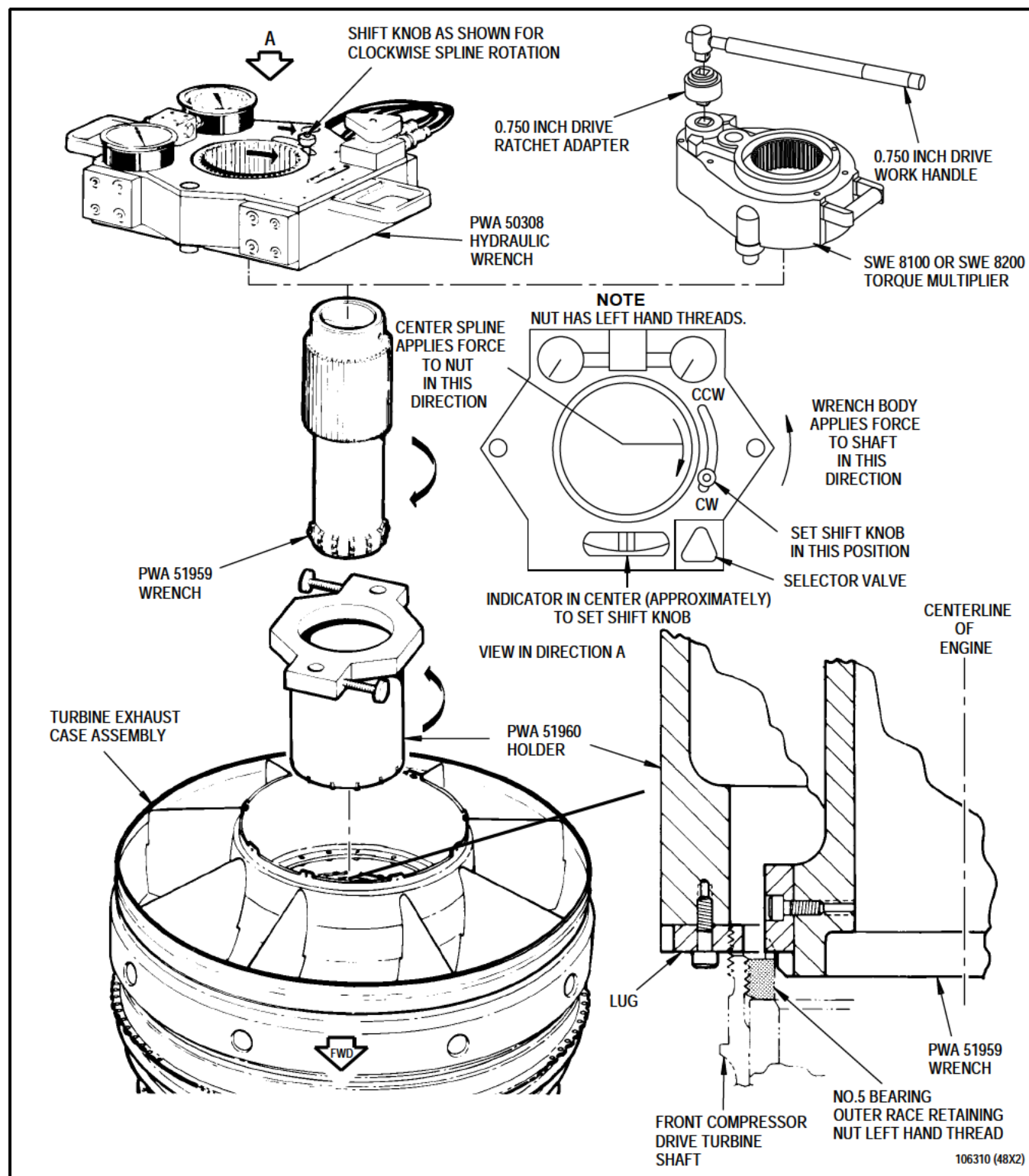


Figure 4. No. 5 Bearing Outer Race Retaining Nut - Removal

7. NO. 5 BEARING OUTER RACE - REMOVAL USING PWA 51010 OR PWA 53878 PULLERS.

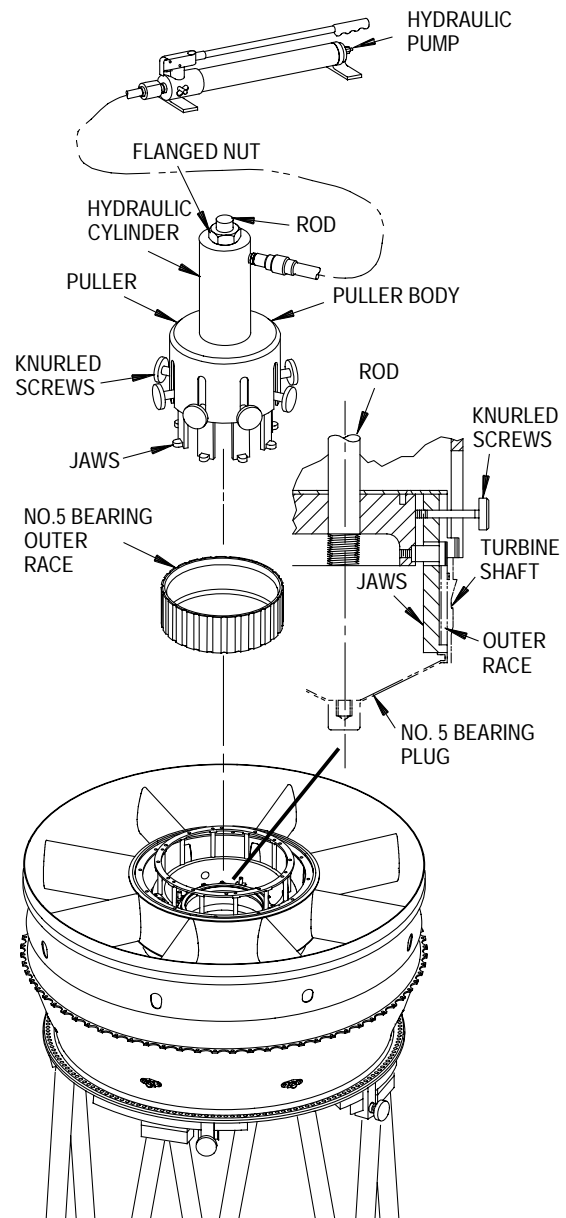
(See Figure 5.)

- a. Remove flanged nut from PWA 51010 or PWA 53878 puller rod.
- b. Remove hydraulic cylinder.
- c. Loosen knurled screws on puller body to allow jaws to fully retract.
- d. Install puller body against turbine shaft. Insert teeth of jaws through slots in No. 5 bearing plug ensuring that teeth locate under outer race.
- e. Tighten knurled screws on puller body to center tool and lock jaws in position.
- f. Install hydraulic cylinder and secure with flanged nut.
- g. Connect PWA 55380 hydraulic pump to coupler on hydraulic cylinder.



To prevent No. 5 bearing outer race damage, visually verify puller jaws are aligned with slots in No. 5 bearing plug and ensure jaws are engaged under bearing race before pulling race.

- h. Work PWA 55380 pump handle to remove No. 5 bearing outer race.
- i. Remove outer race from puller, coat with MIL-L-7808 lubricating oil and store in protective labeled container.



47606 (48X1)

**Figure 5. No. 5 Bearing Outer Race - Removal
Using PWA 51010 or PWA 53878 Pullers**

7A. No. 5 BEARING OUTER RACE - REMOVAL USING PWA 57483 PULLER.

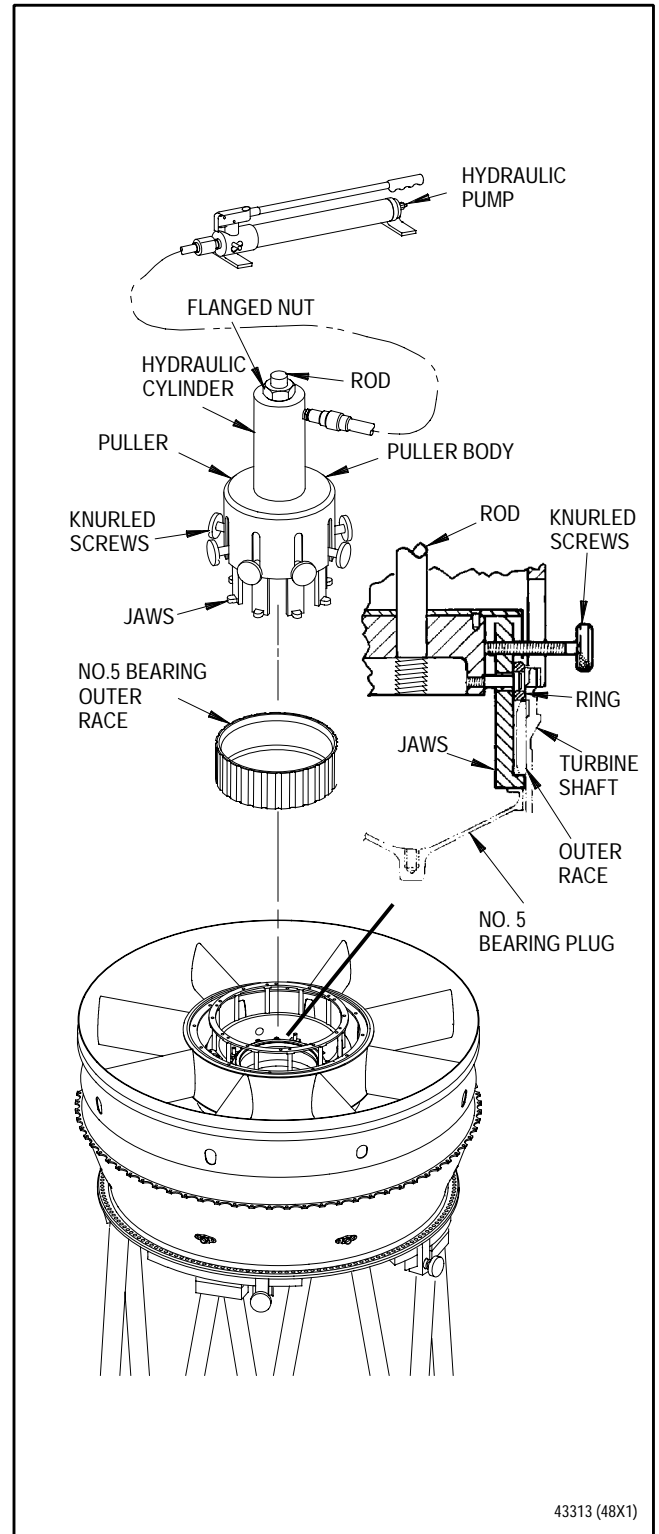
(See Figure 5A.)

- a. Remove flanged nut from rod on PWA 57483 puller.
- b. Remove hydraulic cylinder.
- c. Loosen knurled screws to let jaws fully retract.
- d. Remove puller body from rod.
- e. Install jaws into end of turbine shaft so that ring fits inside end of turbine shaft and rests against No. 5 bearing outer race.
- f. Visually verify that jaws are aligned with slots in No. 5 bearing plug. Turn knurled screws to extend jaws so they fit under No. 5 bearing outer race. Tighten knurled screws hand tight.
- g. Install puller body on rod so that end of puller body rests against end of turbine shaft.
- h. Install hydraulic cylinder on rod and secure with flanged nut.
- i. Connect PWA 55380 hydraulic pump to hydraulic cylinder.



To prevent No. 5 bearing outer race damage, visually verify puller jaws are aligned with slots in No. 5 bearing plug and ensure jaws are engaged under bearing race before pulling race.

- j. Work PWA 55380 pump handle to remove No. 5 bearing outer race.
- k. Remove outer race from puller, coat with MIL-L-7808 lubricating oil and store in protective labeled container.



**Figure 5A. No. 5 Bearing Outer Race - Removal
Using PWA 57483 Puller**

43313 (48X1)

8. TURBINE EXHAUST CASE ASSEMBLY - REMOVAL.

(See Figure 6.)

NOTE

Black and Decker Model Nos. 2430 or 2433 pneumatic wrenches can be used for removal of flange nuts.

- a. Remove nuts and bolts securing turbine exhaust case assembly to rear turbine case.

NOTE

Optional method of removing turbine exhaust case using two(2) people, lifting at struts, is acceptable.

- b. Loop two web straps around two turbine exhaust case struts, 180 degrees apart.
- c. Connect PWA 6580 sling and an overhead hoist, then remove turbine exhaust case assembly. Place assembly in a suitable box or on a parts rack.
- d. Install protective covering onto 4th stage turbine disk air seal.

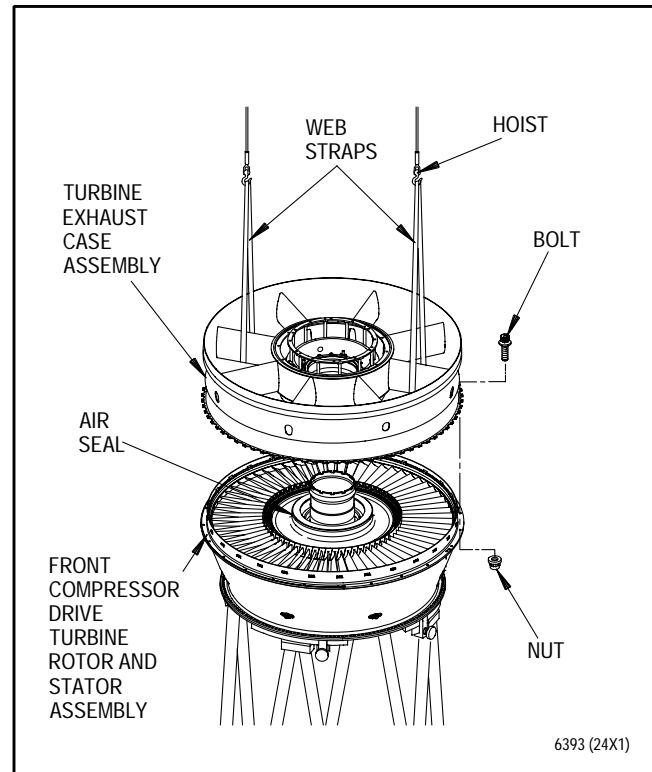


Figure 6. Turbine Exhaust Case Assembly - Removal

INTRODUCTION

DISASSEMBLY OF SUBASSEMBLIES

EFFECTIVITY: ENGINE MODEL F100-PW-229

Total Number of Pages in this WP is 2

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2		20			

1. INTRODUCTION.

This work package introduces the 020 00 through 199 00 series of work packages for disassembly of fan drive turbine module subassemblies. The following work packages are included in this series:

WP/SWP No.	Title
021 00	Rotor and Stator Assembly, Turbine, Front Compressor Drive - Disassembly
022 00	Disk, Blade, Air Sealing Ring, and Air Seal, Third Stage Turbine, and Tierod, Turbine - Disassembly
023 00	Disk and Blades, Fourth Stage Turbine - Disassembly
024 00	Case Assembly, Turbine Exhaust - Disassembly
025 00	Support Assembly, No. 5 Bearing Seal - Disassembly
026 00	Seat - Turbine Shaft Lock - Removal
027 00	Turbine Stator Assembly, Third Stage - Disassembly
028 00	Turbine Stator Assembly, Fourth Stage - Disassembly
029 00	Open
030 00	Support Assembly - No. 5 Bearing Inner, and No. 5 Bearing Inner Race and Rollers - Disassembly
031 00	Shaft Assembly, Front Compressor Drive Turbine - Disassembly

WORK PACKAGE**TECHNICAL PROCEDURES****ROTOR AND STATOR ASSEMBLY, TURBINE,
FRONT COMPRESSOR DRIVE AND
REAR TURBINE CASE AND DUCT SET -****DISASSEMBLY****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 26

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	6B Blank Added	13	13 - 14	0
2	18	7	16	15	13
3	28	8 - 9	0	16	28
4	0	10	28	17	0
5	28	11	13	18	13
6	16	12	28	19 - 20	0
6A Added	13			21 - 24	15

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T. O. No.	Date	Level	Title (ECP No.)
2J-F100-890	15 JUL 95	O/I	Modification of PWA 57447 puller, F100-PW-100/200/220/220E/229 Engines, F15/F16 Aircraft. (ECP 94QC003)
2J-F100229-553	15 FEB 95	O/I	Modification of PWA 57653 tool set, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 94QC004-1)
2J-F100229(III)-508	01 MAR 94	O/I	Install improved durability fourth blade outer air seal, F100-PW-229 Engine, F-15/F-16 Aircraft. (ECP 91QA300)
2J-F100229(III)-516	15 FEB 95	O/I	Remove and replace second stage turbine duct support and segment, F100-PW-229 Engines, F-15/F-16. (ECP 90QA218)
2J-F100229(III)-517	15 FEB 95	D	Installation of improved durability 4th stage turbine blade PN 4082504, disk PN 4082604, and air seal PN 4082297, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 93QA253R1C1)
2J-F100229(III)-518	15 FEB 95	O/I	Installation of improved durability 4th stage turbine blade PN 4082504, disk PN 4082604, and air seal PN 4082297, F100-PW-229 Engines, F-15 Aircraft. (ECP 93QA253R1)

CONSUMABLE MATERIALS**Nomenclature**

PENCIL (CRAYON), SILVER, METAL
MARKING (HARD)

Specification/Vendor Part Number

COLORBRITE NO. 2101
OR
COLOR-TEX NO. 1843
OR
ANADEL NO. 1936

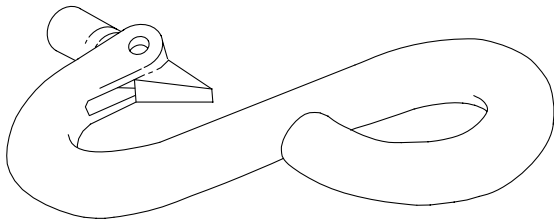
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

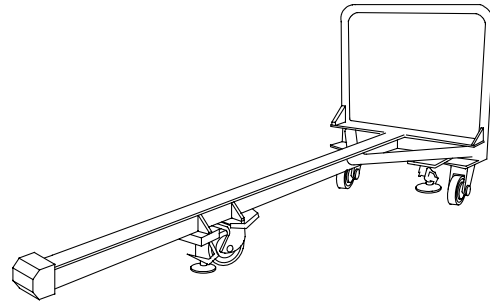
Paragraph	Function - Tool Nomenclature	Tool Number
3	FRONT COMPRESSOR DRIVE TURBINE SHAFT - REMOVAL	
	PULLER, TURBINE SHAFT - - - - -	PWA 57811
	PUMP, HYDRAULIC - - - - -	PWA 55380
	EYE, LIFTING - - - - -	PWA 51026
	TRUCK, FRONT COMPRESSOR DRIVE TURBINE - - - - -	PWA 10673
	SUPPORT, FRONT COMPRESSOR DRIVE TURBINE - - - - -	PWA 10687
	CLAMP, TURBINE SHAFT TO TRUCK - - - - -	PWA 50973
4	FRONT COMPRESSOR DRIVE TURBINE ROTOR AND STATOR (WITHOUT TURBINE DRIVESHAFT) - DISASSEMBLY	
	ADAPTER, TORQUE SET - INSTALL/REMOVE LOW TURBINE TIE BOLTS (PART OF PWA 57810 TOOL SET) - - - - -	PWA 57809
	TOOL SET - FAN DRIVE TURBINE ROTOR, ASSEMBLY/ DISASSEMBLY - - - - -	PWA 57810
		OR
		PWA 57653
	PUMP, HYDRAULIC - - - - -	PWA 51946
	HOOK, SAFETY - - - - -	PWA 2388
	PULLER, 4TH STAGE TURBINE AIR SEAL (PART OF PWA 57810 TOOL SET) - - - - -	PWA 57600
5	REAR TURBINE CASE ASSEMBLY - REMOVAL OF SECOND STAGE TURBINE DUCT SUPPORT AND SEGMENTS	
	DRIVER, DUCT SEGMENTS - - - - -	PWA 53354

ILLUSTRATED SUPPORT EQUIPMENT



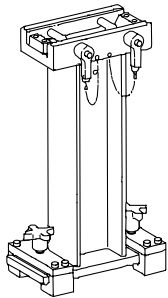
PWA 2388 -C

Figure T1. PWA 2388 Hook



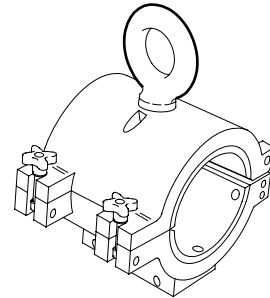
PWA 10673 -C

Figure T2. PWA 10673 Truck



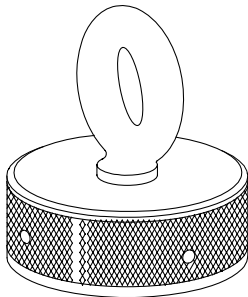
PWA 10687 -C

Figure T3. PWA 10687 Support



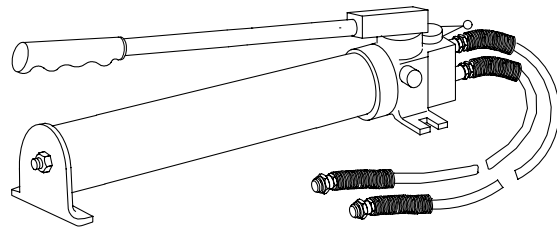
PWA 50973 -C

Figure T4. PWA 50973 Clamp



PWA 51026 -C

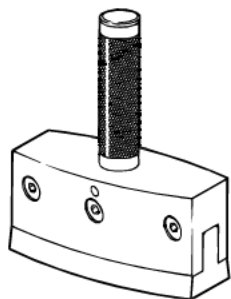
Figure T5. PWA 51026 Eye



PWA 51946 -C

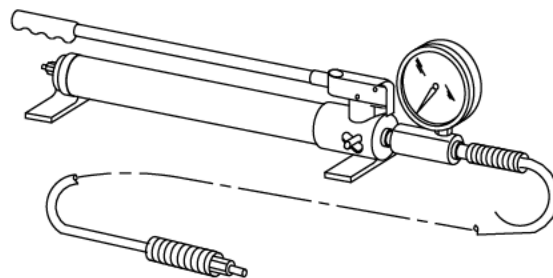
Figure T6. PWA 51946 Pump

ILLUSTRATED SUPPORT EQUIPMENT (continued)



PWA 53354 -C

Figure T7. PWA 53354 Driver

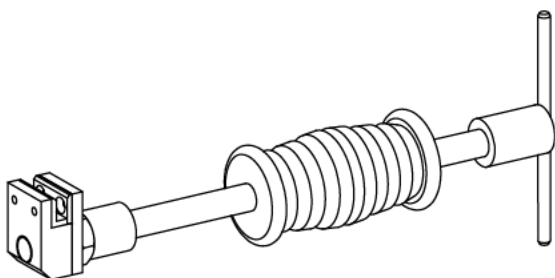


PWA 55380 -C

Figure T8. PWA 55380 Pump

Figure T9. Deleted.

Figure T10. Deleted.



PWA 57600 -C

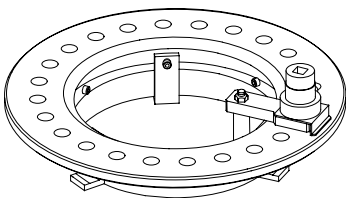
Figure T11. PWA 57600 Puller



PWA 57653 -C

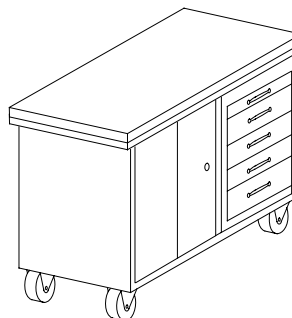
Figure T12. PWA 57653 Tool Set

ILLUSTRATED SUPPORT EQUIPMENT (continued)



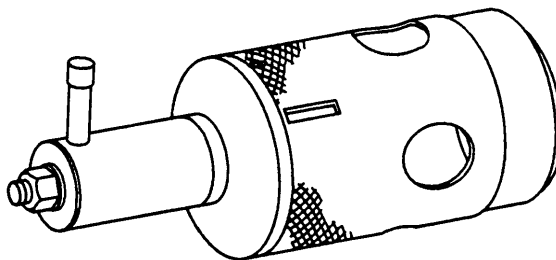
PWA 57809 -C

Figure T13. PWA 57809 Adapter



PWA 57810 -C

Figure T14. PWA 57810 Tool Set



PWA 57811 -C

Figure T15. PWA 57811 Puller

1. INTRODUCTION.

a. This work package contains instructions for disassembly of front compressor drive turbine rotor and stator. The following major parts are removed:

- Front compressor drive turbine shaft
- Fourth stage disk and blades
- Fourth stage turbine air seal
- Fourth stage turbine air sealing ring segments and support assembly
- Fourth stage turbine stator vane assembly
- Rear turbine hub assembly
- Second stage turbine duct segments and second stage turbine duct support
- Third stage turbine rotor and blades
- Third stage turbine stator assembly
- Rear turbine case and duct set.

2. PRELIMINARY INSTRUCTIONS.

a. Disassemble fan drive turbine module per WP 012 00.

3. FRONT COMPRESSOR DRIVE TURBINE SHAFT - REMOVAL.

(See Figure 1.)

- a. Remove front compressor drive turbine shaft using PWA 57811 puller as follows:
(See figure 1, Sheet 1.)
 - (1) Remove PWA 57811 flanged nut from threaded shaft. Remove detail-3 adapter from detail-1 body.
 - (2) Thread PWA 57811 puller detail-3 adapter on OD threads of turbine shaft.
 - (3) Position detail-1 body on end of rear hub. Thread flanged nut onto threaded rod.
 - (4) Connect PWA 55380 pump to detail-4 cylinder.
 - (5) Actuate pump to separate turbine shaft from turbine rear hub assembly.
 - (6) Remove puller and pump.
 - (7) Remove PWA 51056 lifting eye and PWA 57704 detail-46 C-washer (detail of PWA 57818 adapter) from turbine shaft.

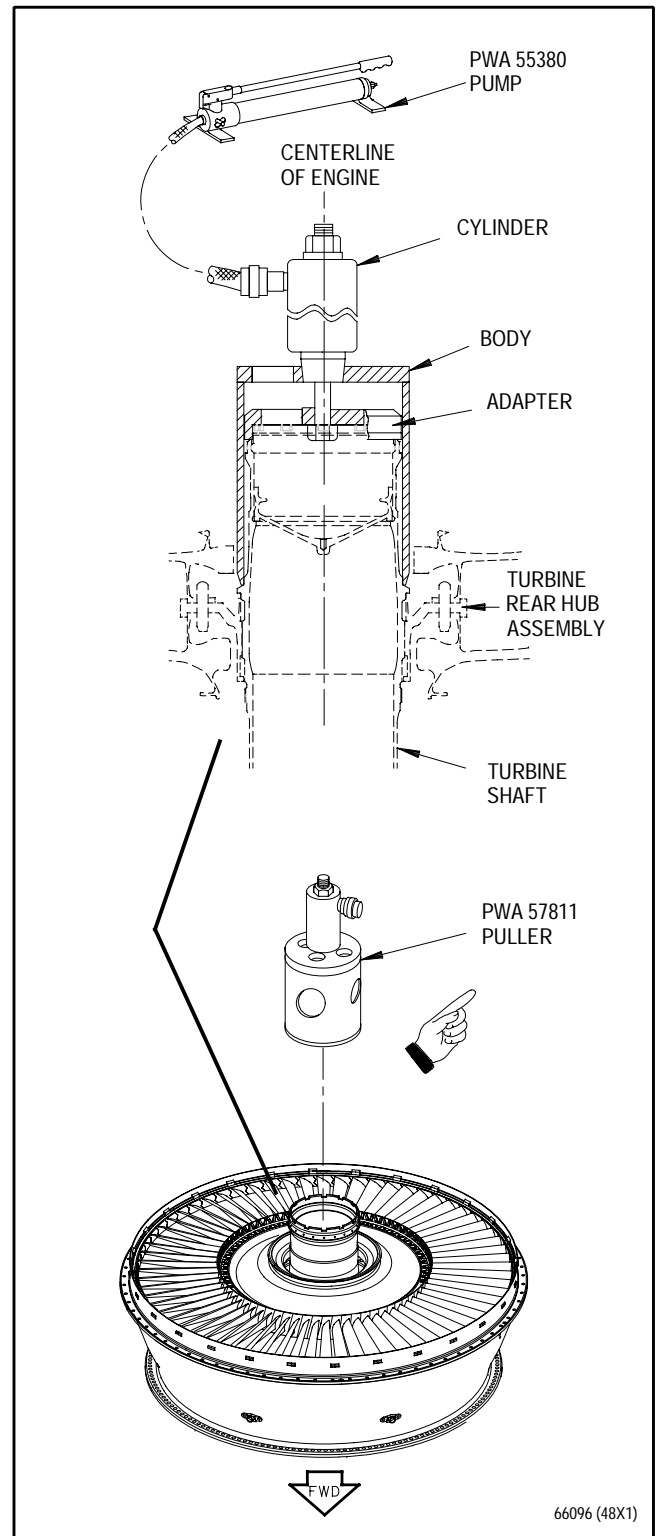


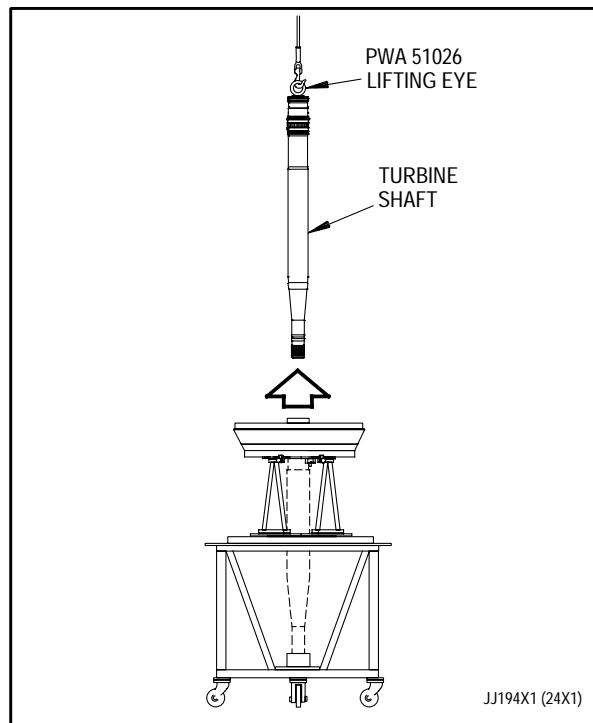
Figure 1. Front Compressor Drive Turbine Shaft - Removal (Sheet 1 of 3)

- (8) Install PWA 51026 lifting eye on turbine shaft.



Avoid movement of rotor and stator assembly after turbine shaft has been removed to prevent damage to knife-edge and abradable seals.

- (9) Attach an overhead hoist to lifting eye and remove turbine shaft.



**Figure 1. Front Compressor Drive
Turbine Shaft - Removal (Sheet 2 of 3)**

- b. Install turbine shaft into PWA 10673 truck as follows:
- (1) Install PWA 10687 support onto truck. Tighten PWA 10687 support detail-15 hand knobs to secure support to truck.
 - (2) Install PWA 50973 clamp onto support. Secure clamp onto support with PWA 10687 support detail-12 ball lock pins.
 - (3) Lower turbine shaft onto PWA 50973 clamp. Tighten clamp detail-5 hand knobs to secure shaft. Remove PWA 51026 lifting eye.
 - (4) Install protectors on front and rear end of turbine shaft.

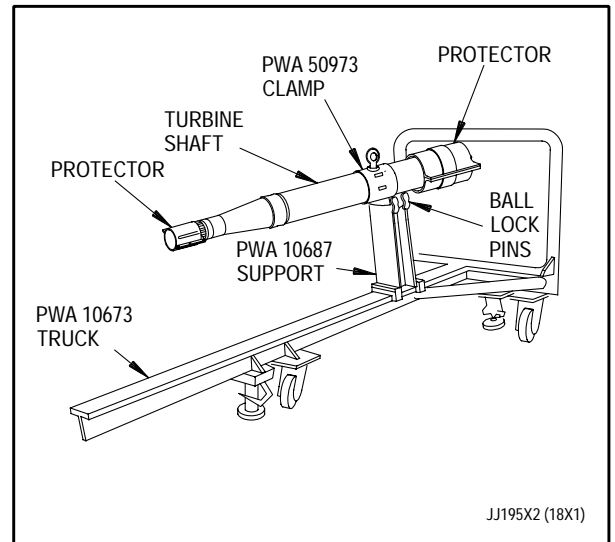


Figure 1. Front Compressor Drive Turbine Shaft - Removal (Sheet 3 of 3)

4. FRONT COMPRESSOR DRIVE TURBINE ROTOR AND STATOR (WITHOUT TURBINE DRIVESHAFT) - DISASSEMBLY.

(See Figure 2.)

- a. Remove tierod nuts as follows:
(See figure 2, Sheet 1.)

NOTE

Do not unbend key washer tabs.
Loosening tierod nuts will
straighten tabs.

- (1) Install PWA 57809 detail-12 spacer onto detail-5 locator ring with nylon screws.
- (1a) Install PWA 57809 adapter detail-5 locator ring onto 4th stage disk.
- (2) Align No. 1 position on detail-5 locator ring with No. 1 blade slot on 4th stage turbine disk at 12 o'clock position, indicated by X marks on disk for trees adjacent to No. 1 blade slot.
- (3) Deleted.
- (4) Secure detail-5 locator ring with three detail-6 clamps, bevel end up, evenly spaced. Use three detail-3 cap screws to secure detail-6 clamps.

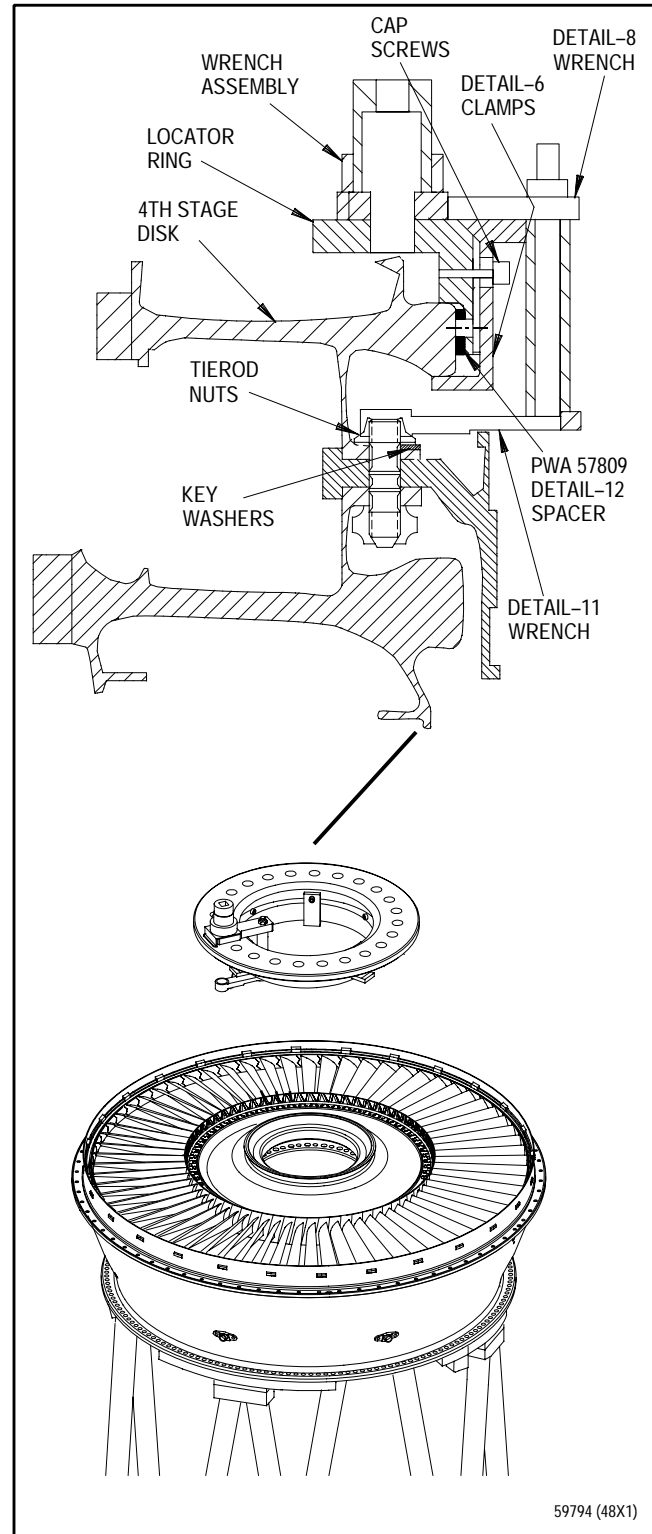


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 1 of 12)

- (5) Loosen tierod nuts, 1/4 turn at a time, in sequence stamped on detail-5 locator ring until torque is relieved.
 - (6) Remove tooling used to loosen tierod nuts.
 - (7) Using standard wrench or breaker bar and detail-8 wrench assembly remove tierod nuts.
 - (8) Remove and discard key washers.
- b. Remove 4th stage turbine disk as follows: (See figure 2, Sheet 2.)

NOTE

Support equipment identified as PWA 57653 detail-X in this WP are details of PWA 57810 tool set.

- (1) Lower PWA 57653 detail-1-1 hub adapter onto rear flange of turbine rear hub assembly.
- (2) Secure detail-1-1 hub adapter with detail-1-2 hub adapter lock nuts.
- (3) Thread detail-1-2 hub adapter lock nut onto detail-1-1 hub adapter from front end of module.

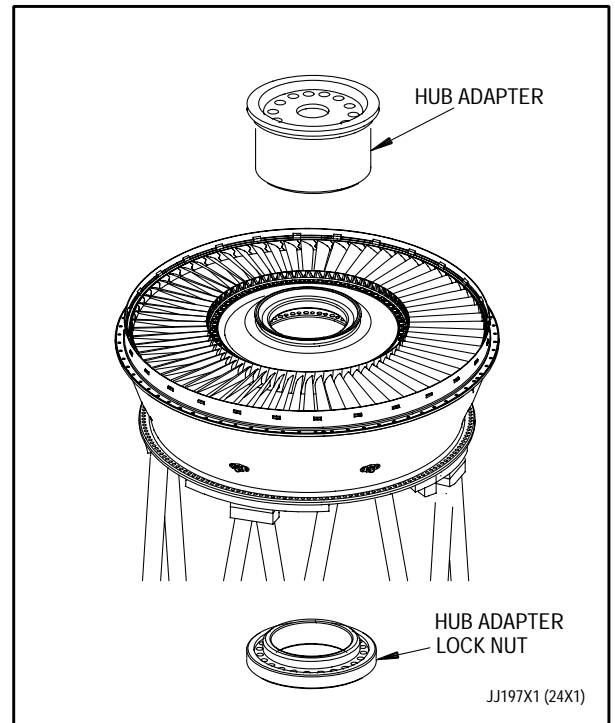


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 2 of 12)

- (4) Thread detail-2-3 shaft onto PWA 57810-11 hydraulic cylinder; then thread hydraulic cylinder into detail-1-2 hub adapter lock nut at front end of module. (See figure 2, Sheet 3.)
- (5) Clip detail-3 lock assembly on detail-2-3 shaft so that lock assembly engages lower groove in shaft.
- (5a) Do not install PWA 57810-18 spacer on 60 blade disk.

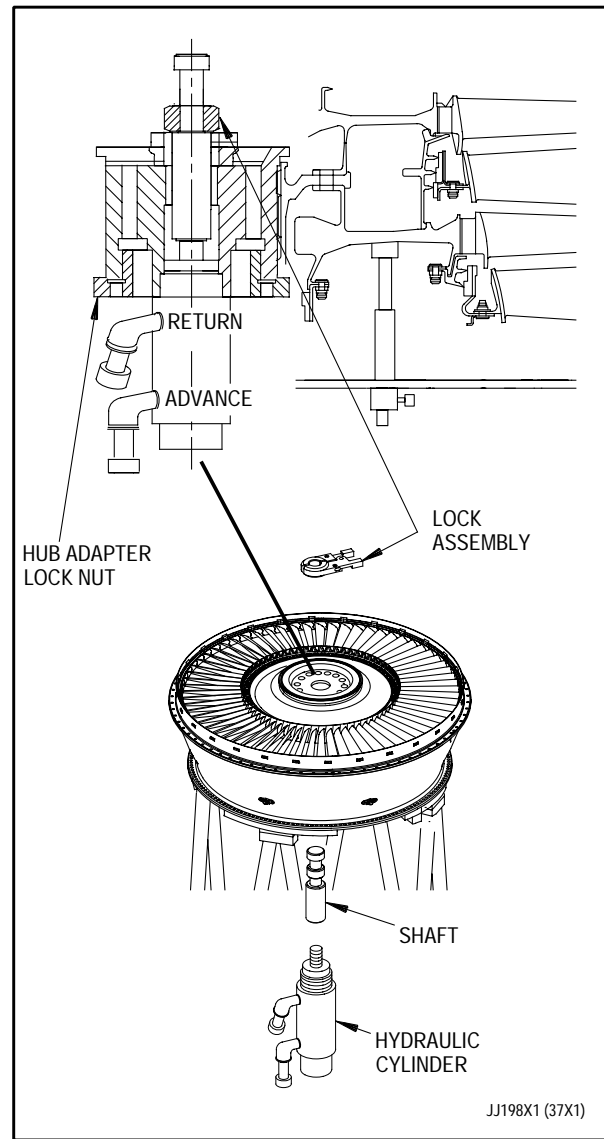


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 3 of 12)

NOTE

It may be necessary to connect PWA 51946 pump to couplers on cylinder and adjust shaft so that detail-4 4th stage puller assembly can be fastened to 4th stage disk.

- (6) Depress pins and rotate handles inward. Lower detail-4 4th stage puller assembly onto 4th stage disk. (See figure 2, Sheet 4.)
- (7) Depress pins and rotate handles outward to lock detail-4 4th stage puller assembly in position.
- (8) Ensure detail-3 lock assembly is visible through slot in detail-4 4th stage puller assembly.

NOTE

It may be necessary to connect PWA 51946 pump to couplers and adjust detail-2-3 shaft so it can receive detail-4-17 clamp.

- (9) Slide detail-4-17 clamp inward to engage upper groove in detail-2-3 shaft.
- (10) Connect PWA 51946 pump to couplers on detail-2-1 hydraulic cylinder.

WARNING

Stay clear when separating 4th stage disk and blades. Disk will separate suddenly and with great force.

- (11) Actuate PWA 51946 pump to separate 4th stage disk from turbine rear hub assembly.
- (12) Relieve pressure from PWA 51946 pump. Disconnect pump from couplers.

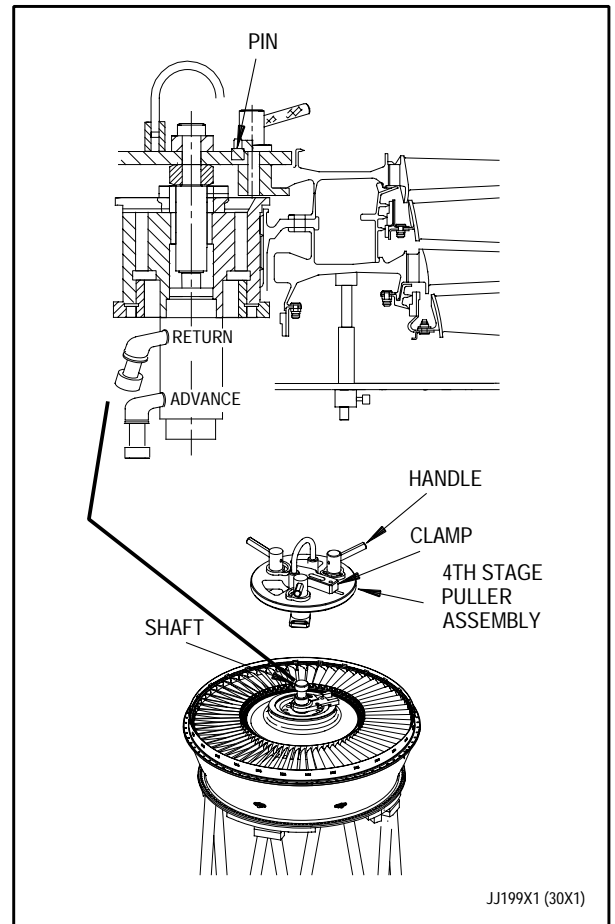


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 4 of 12)

- (13) Retract detail-4-17 clamp clear of detail-2-3 shaft.
- (14) Attach an overhead hoist and PWA 2388 hook to eye. (See figure 2, Sheet 5.)
- (14a) Retain blades with a strap or wire during removal.
- (15) Operate hoist and carefully remove 4th stage disk and blades from rear turbine case and duct set.

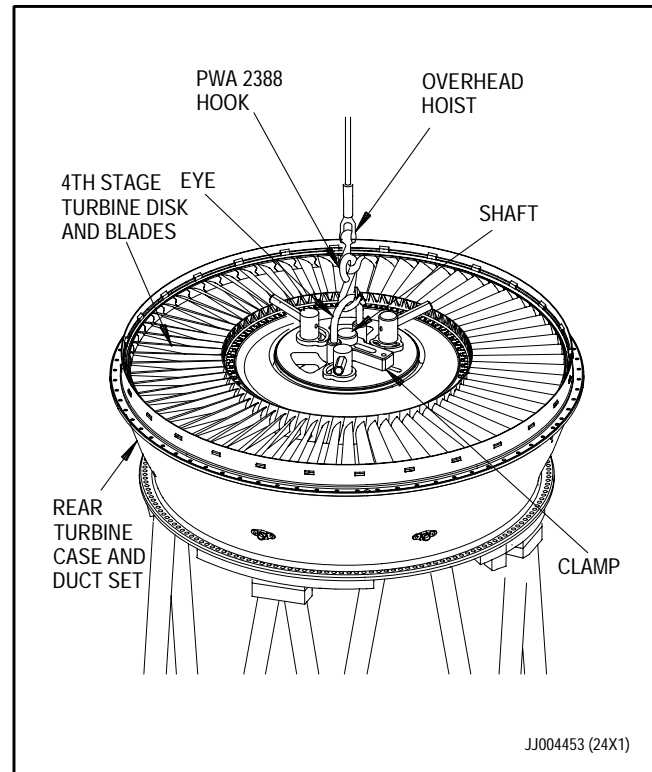


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 5 of 12)

NOTE

It is possible for 4th stage air seal to separate with 4th stage disk. In this situation, air seal is removed from 4th stage disk while raised on hoist, and by accomplishing following steps.

- (16) Mark location of 4th stage turbine air seal using Colorbrite No. 2101 silver pencil or equivalent.
- (17) If necessary, remove 4th stage turbine air seal from 4th stage disk using PWA 57600 puller. Use two technicians; one to hold air seal and other to operate puller.
- (18) Place 4th stage disk and blades on bench. Remove detail-4 4th stage puller assembly. Remove PWA 57810-18 spacer, if installed.
- (19) Remove lock assembly from shaft.
- (20) Mark location of 4th stage turbine air seal using Colorbrite No. 2101 silver pencil or equivalent.
- (21) Remove 4th stage turbine air seal using PWA 57600 puller. Work slide hammer of puller and reposition puller around air seal inner flange until air seal is unseated.

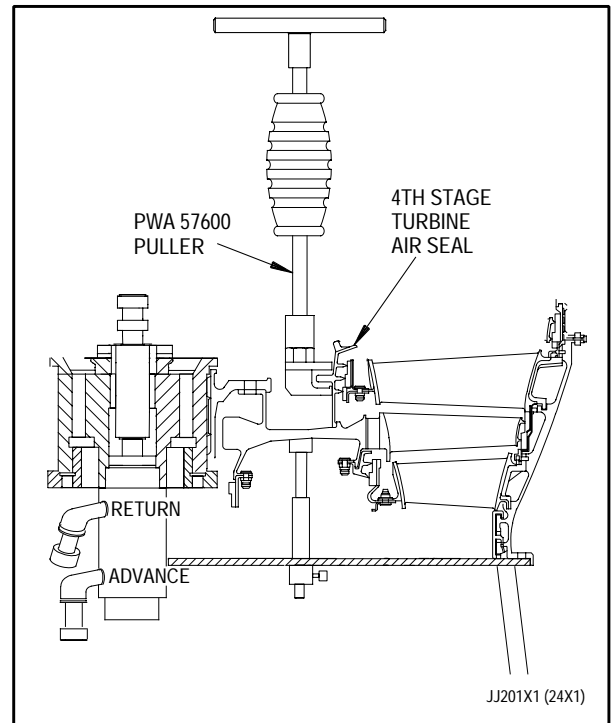


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 6 of 12)

c. Mark location of 4th stage turbine air sealing ring support to turbine case assembly using Colorbrite No. 2101 silver pencil or equivalent. (See figure 2, Sheet 7.)

c1. Deleted.

c2. Deleted.

c3. Remove 4th stage turbine air sealing ring support and air sealing ring segments as follows:

- (1) Remove three screws and nuts.
- (2) Unseat support and segment assembly by lightly tapping with a soft-faced mallet.
- (3) Slide 4th stage turbine air sealing ring segments forward in support. If necessary, lightly tap segments forward with soft-faced mallet or hammer and brass or fiber drift. Tilt segments slightly toward center of support and disengage segment hooks from support slots. Mark location on segments and support for assembly using Colorbrite No. 2101 silver pencil or equivalent.

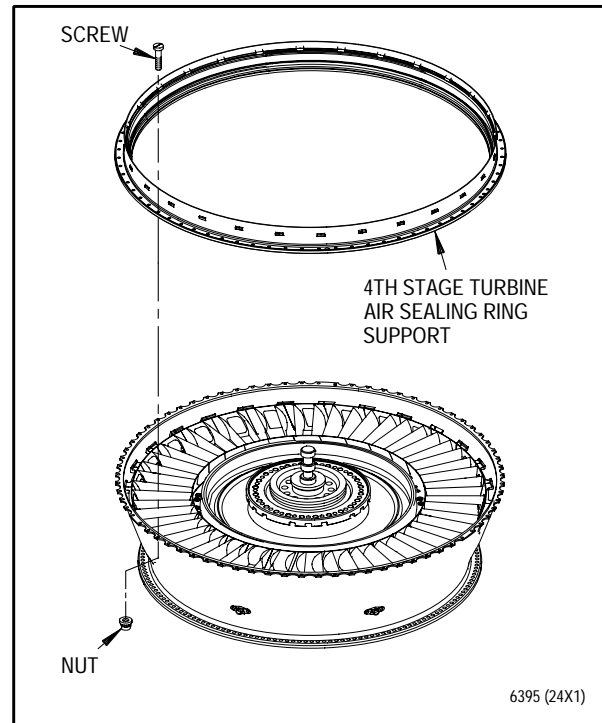


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 7 of 12)

d. Remove 4th stage turbine stator vane assembly as follows:

- (1) Remove 4th stage retaining ring.
- (2) Loosen vane feet from case and duct set by lightly tapping with a soft-faced mallet.
- (3) Lift vane assembly from case and duct set and place on bench.

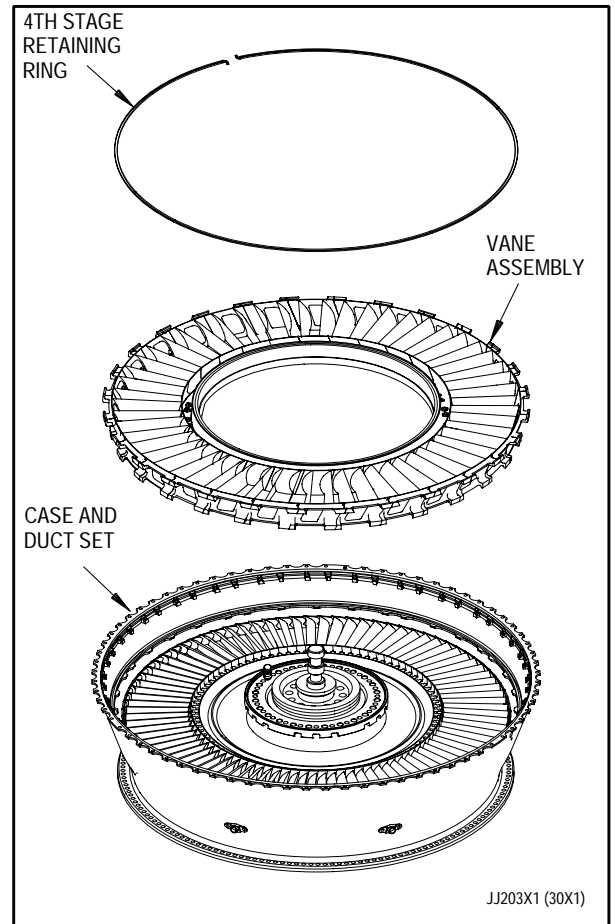


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 8 of 12)

e. Remove rear turbine hub assembly as follows: (See figure 2, Sheet 9.)

- (1) Lower PWA 57653 detail-5 3rd stage pusher/support onto 3rd stage disk.

NOTE

It may be necessary to connect PWA 51946 pump to couplers and adjust detail-2-3 shaft so it can receive detail-3 lock assembly.

- (2) Clip detail-3 lock assembly on detail-2-3 shaft so that lock assembly engages lower groove in shaft.
- (3) Connect PWA 51946 pump to couplers on PWA 57810-11 hydraulic cylinder.
- (4) Actuate PWA 51946 pump to retract detail-2-3 shaft to separate hub from 3rd stage disk.
- (5) Relieve pressure; then disconnect PWA 51946 pump from couplers.
- (6) Remove tooling from hub assembly.

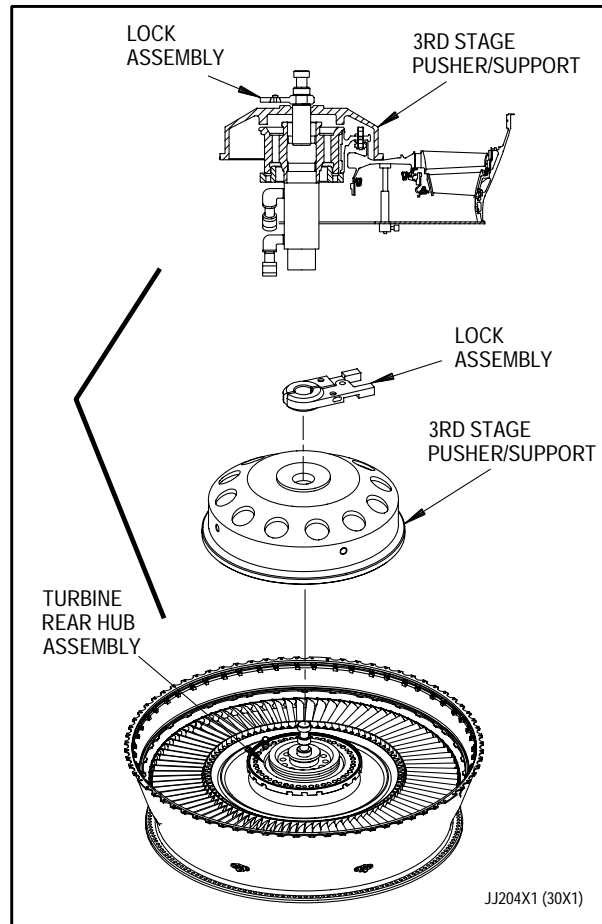


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 9 of 12)

f. Remove 3rd stage disk and blades as follows: (See figure 2, Sheet 10.)

- (1) Position detail-7 lifting assembly over 3rd stage disk and blades so that three detail-7-2 knobs are in line with three tierods.
- (2) Screw detail-7-2 knobs onto three tierods. Hand tighten knobs.
- (3) Attach overhead hoist on PWA 2388 hook to detail-7-4 lifting eye.
- (4) Retain blades with strap or wire to prevent blades from falling out during removal.
- (5) Carefully remove 3rd stage disk and blades from case and duct set, and place on bench.
- (6) Remove detail-7 lifting assembly from 3rd stage disk and blades.

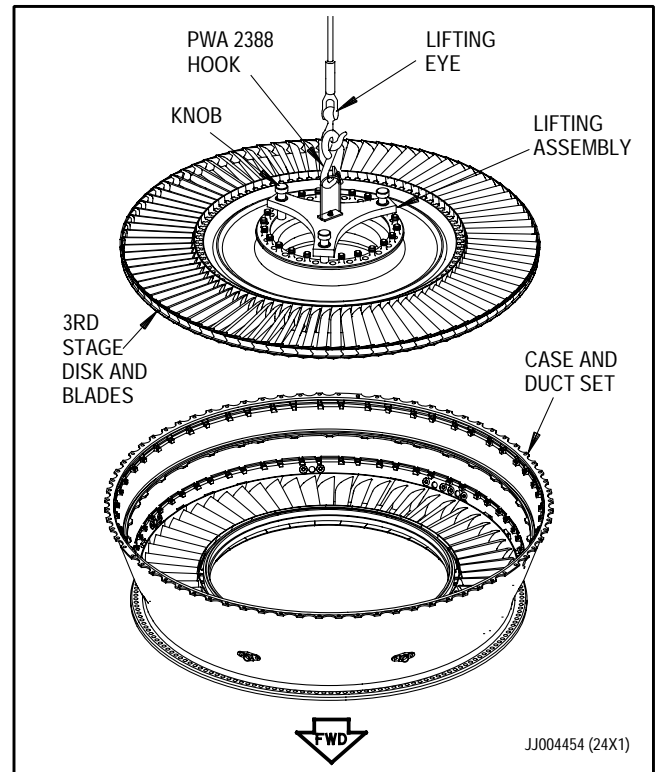


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 10 of 12)

- g. Remove 3rd stage turbine air sealing ring segments as follows:
(See figure 2, Sheet 11.)
- (1) Number each 3rd stage turbine air sealing ring segment in consecutive order. Use a silver pencil to mark segments.
 - (2) Loosen air sealing ring segments by lightly tapping with a soft-faced mallet.
 - (3) Remove air sealing ring segments from case and duct set.

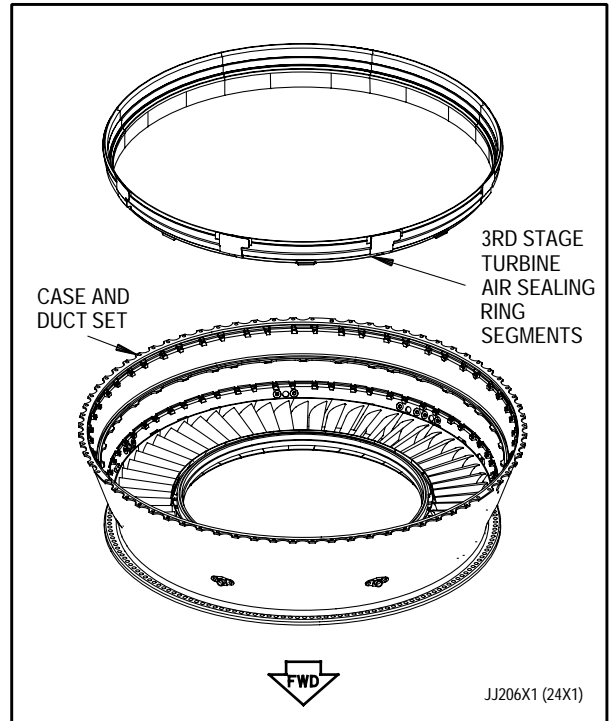


Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 11 of 12)

h. Remove 3rd stage turbine stator assembly as follows:
(See figure 2, Sheet 12.)

- (1) Remove 3rd stage retaining ring segments. Mark location of segments using Colorbrite No. 2101 silver pencil or equivalent.
- (2) Loosen vane feet from rear turbine case assembly by lightly tapping with a soft-faced mallet.
- (3) Lift 3rd stage stator assembly from rear turbine case assembly and place on bench.



Second stage turbine support and duct set is loose fit inside rear turbine case assembly and will be damaged if allowed to fall from case during handling.

- i. Remove rear turbine case assembly from build stand while manually holding 2nd turbine support and duct set in place in case. Place case assembly rear flange down on bench.

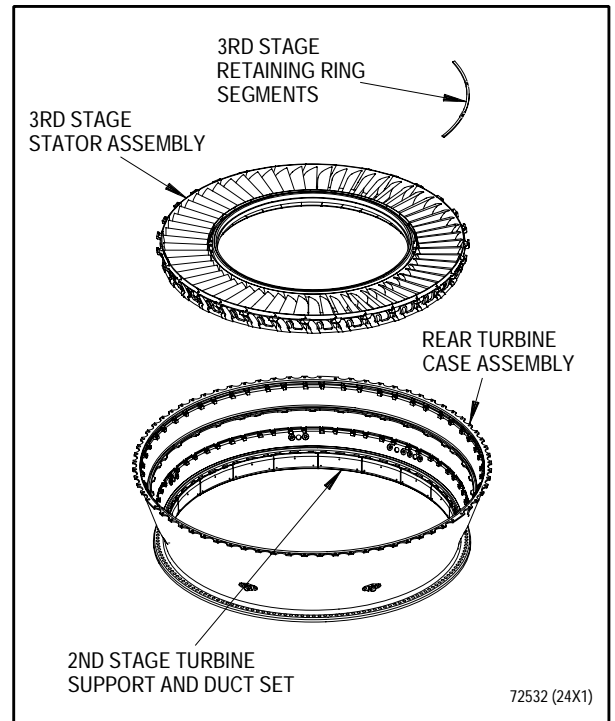


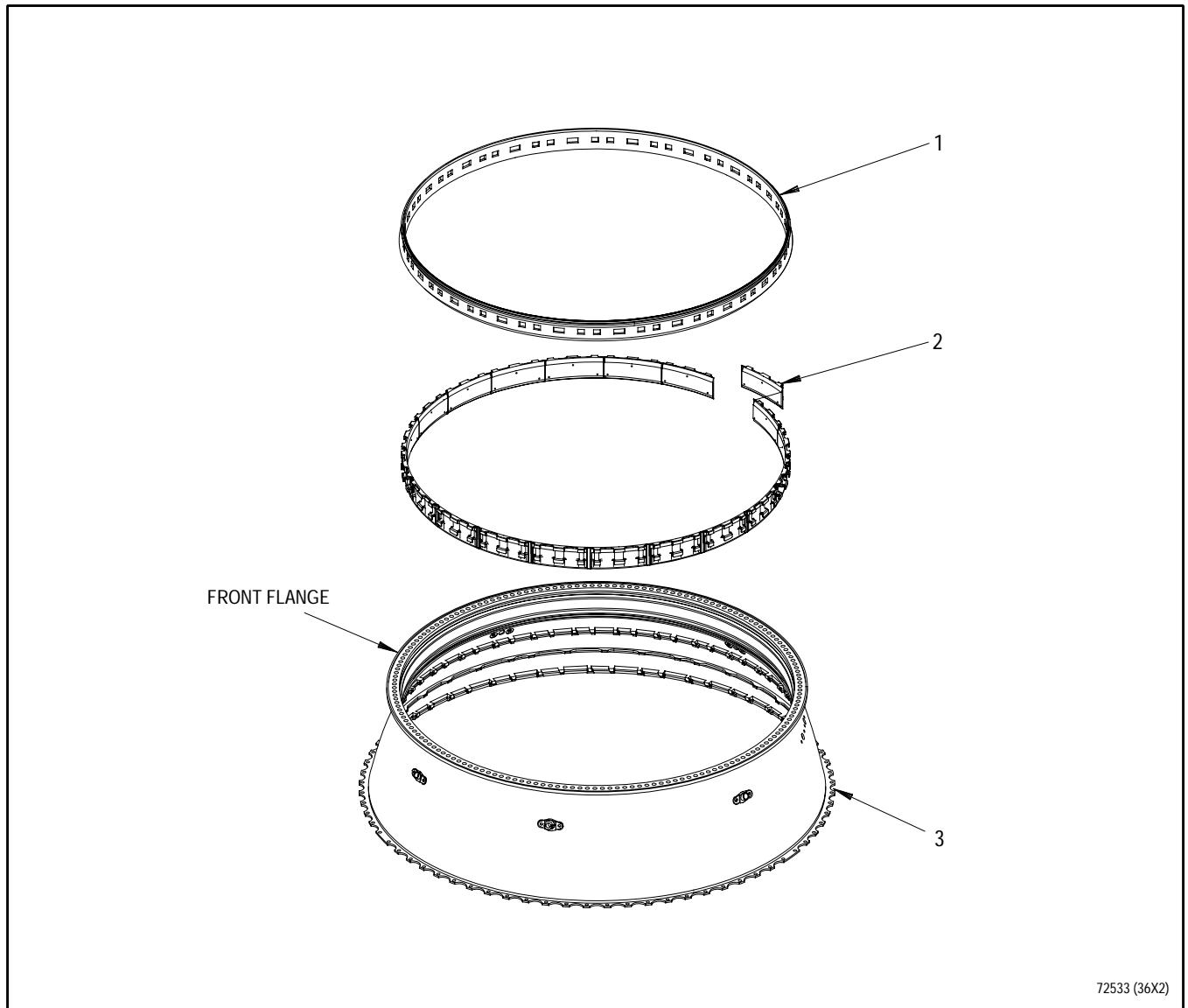
Figure 2. Front Compressor Drive Turbine Rotor and Stator - Disassembly (Sheet 12 of 12)

**5. REAR TURBINE CASE ASSEMBLY -
REMOVAL OF SECOND STAGE TURBINE DUCT
SUPPORT AND SEGMENTS.**

(See Figure 3.)

- a. Place rear turbine case assembly rear flange down on bench.
- b. Lift 2nd stage turbine support and duct set(1 and 2, figure 3) from rear turbine case(3). If necessary, support and duct set may be removed by drifting forward using PWA 53354 driver.
- c. Remove duct segments(2) from duct support(1) as follows:
 - (1) Place support and duct set on bench rear face down.

- (2) Locate O marked on forward face of support. Starting at O mark, number segments one through 20 in counterclockwise direction. Mark each segment on outside of center hook and corresponding position on OD of support using Colorbrite No. 2101 silver pencil or equivalent.
- (3) Remove duct segments from support by drifting rearward with PWA 53354 driver.



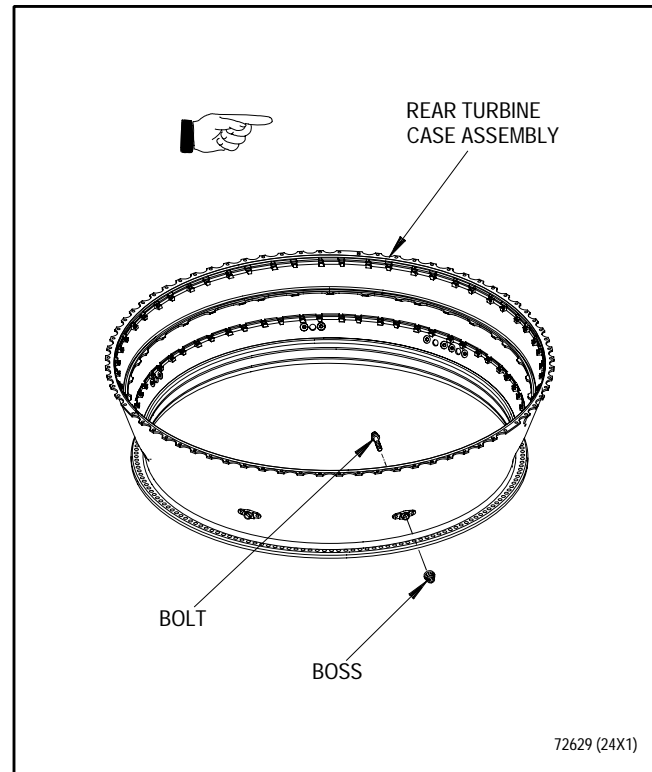
1. Second stage turbine duct support
2. Second stage turbine duct segment
3. Rear turbine case assembly

Figure 3. Rear Turbine Case Assembly - Removal of Second Stage Turbine Duct Support and Segments

6. REAR TURBINE CASE INSTRUMENTATION AND BORESCOPE BOSSES - REMOVAL.

(See Figure 4.)

- a. Remove nuts and bolts securing borescope boss.
- b. Remove borescope boss.
- c. Remove bolts securing FTIT probe bosses.
- d. Remove bosses.



**Figure 4. Rear Turbine Case Instrumentation
and Borescope Bosses - Removal**

WORK PACKAGE**TECHNICAL PROCEDURES**

**DISK, BLADE, AIR SEALING RING, AND
AIR SEAL, THIRD STAGE TURBINE, AND
TIEROD, TURBINE -**

DISASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 14

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	27	6	21	9	21
2	13	7	13	10	23
3 - 4	27	8	0	11	0
5	13			12 - 14	27

REFERENCE MATERIAL REQUIRED

Title	Number
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Service Cycle Marking - - - - -	WP 314 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T.O. No.	Date	Level	Title (ECP No.)
2J-F100229-553	15 Feb 1995	O/I	Modification of PWA 57653 tool set, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 94QC004-1)

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Pencil (crayon), silver, metal marking (hard)	Colorbrite No. 2101, or Color-Tex No. 1843 or Anadel No. 1936

EXPENDABLE ITEMS

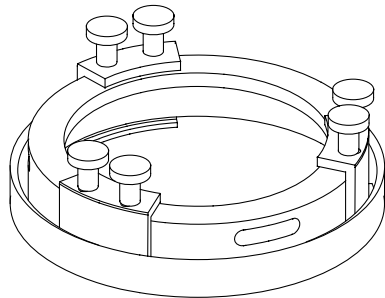
None

APPLICABLE SUPPORT EQUIPMENT

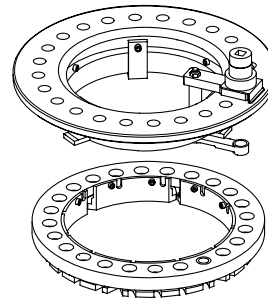
Paragraph	Function - Tool Nomenclature	Tool Number
3	Third Stage Turbine Air Seal - Removal	
	Puller, 4th stage turbine air seal (part of PWA 57810 tool set) - - - - -	PWA 57600
	Tool set - fan drive turbine rotor, assembly/disassembly - - - - -	PWA 57810 or PWA 57653
4	Third Stage Turbine Air Sealing Ring - Removal	
	Puller, air seal, 3rd stage, inner (part of PWA 57810 tool set) - - - - -	PWA 57525
	Puller, 4th stage turbine air seal (part of PWA 57810 tool set) - - - - -	PWA 57600
	Tool set - fan drive turbine rotor, assembly/disassembly - - - - -	PWA 57810 or PWA 57653

APPLICABLE SUPPORT EQUIPMENT (continued)

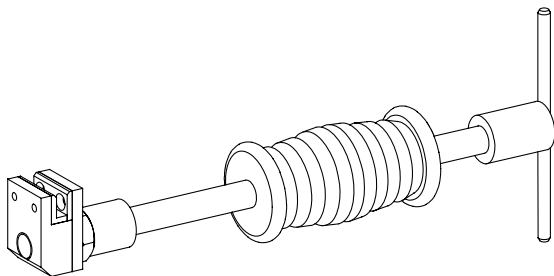
Paragraph	Function - Tool Nomenclature	Tool Number
5	THIRD STAGE TURBINE BLADES - REMOVAL	
	TOOL SET, FAN DRIVE TURBINE ROTOR, ASSEMBLY/ DISASSEMBLY - - - - -	PWA 57810 OR
	SET, TOOL, FAN DRIVE TURBINE ROTOR ASSY - - - - -	PWA 57653
	FIXTURE, HOLDING - - - - -	PWA 71475
6	TURBINE TIERODS - REMOVAL	
	SUPPORT, RETAINING NUTS, TURBINE TIEROD - - - - -	PWA 57908 OR
	TOOL, ASSEMBLY, LOW TURBINE TIERODS (PART OF PWA 57810 TOOL SET) - - - - -	PWA 57528
	TOOL SET, FAN DRIVE TURBINE ROTOR, ASSEMBLY/ DISASSEMBLY - - - - -	PWA 57810 OR
	SET, TOOL, FAN DRIVE TURBINE ROTOR ASSY - - - - -	PWA 57653

ILLUSTRATED SUPPORT EQUIPMENT

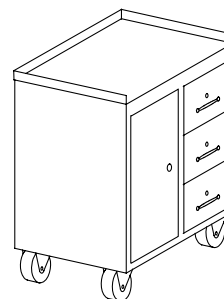
PWA 57525 -C

Figure T1. PWA 57525 PULLER

PWA 57528 -C

Figure T2. PWA 57528 TOOL

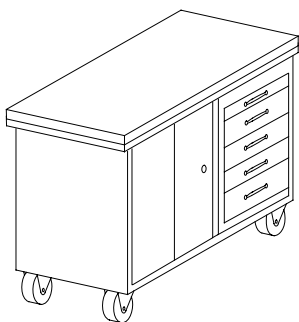
PWA 57600 -C

Figure T3. PWA 57600 PULLER

PWA 57653 -C

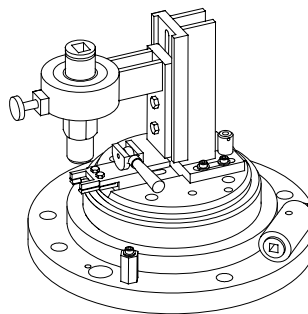
Figure T4. PWA 57653 SET

ILLUSTRATED SUPPORT EQUIPMENT (continued)



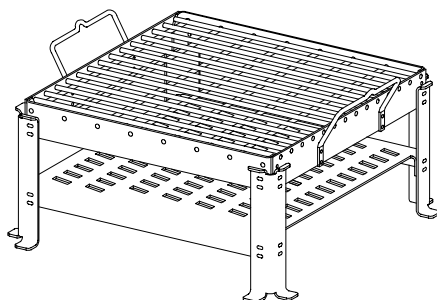
PWA 57810 -C

Figure T5. PWA 57810 TOOL SET



PWA 57908 -C

Figure T6. PWA 57908 SUPPORT



PWA 71475 -C

Figure T7. PWA 71475 FIXTURE

1. INTRODUCTION.

- a. This work package contains instructions for removal of following major parts from 3rd stage turbine disk:
- Third stage turbine air sealing ring
 - Third stage turbine air seal
 - Third stage turbine blades
 - Turbine tierods

2. PRELIMINARY INSTRUCTIONS.

- a. If necessary, remove 3rd stage turbine disk per WP 021 00.

3. THIRD STAGE TURBINE AIR SEAL - REMOVAL.

(See Figure 1.)

NOTE

Support equipment identified as PWA 57653 detail-X in this WP are details of PWA 57810 tool set.

- a. Remove 3rd stage turbine air seal. (See figure 1.)

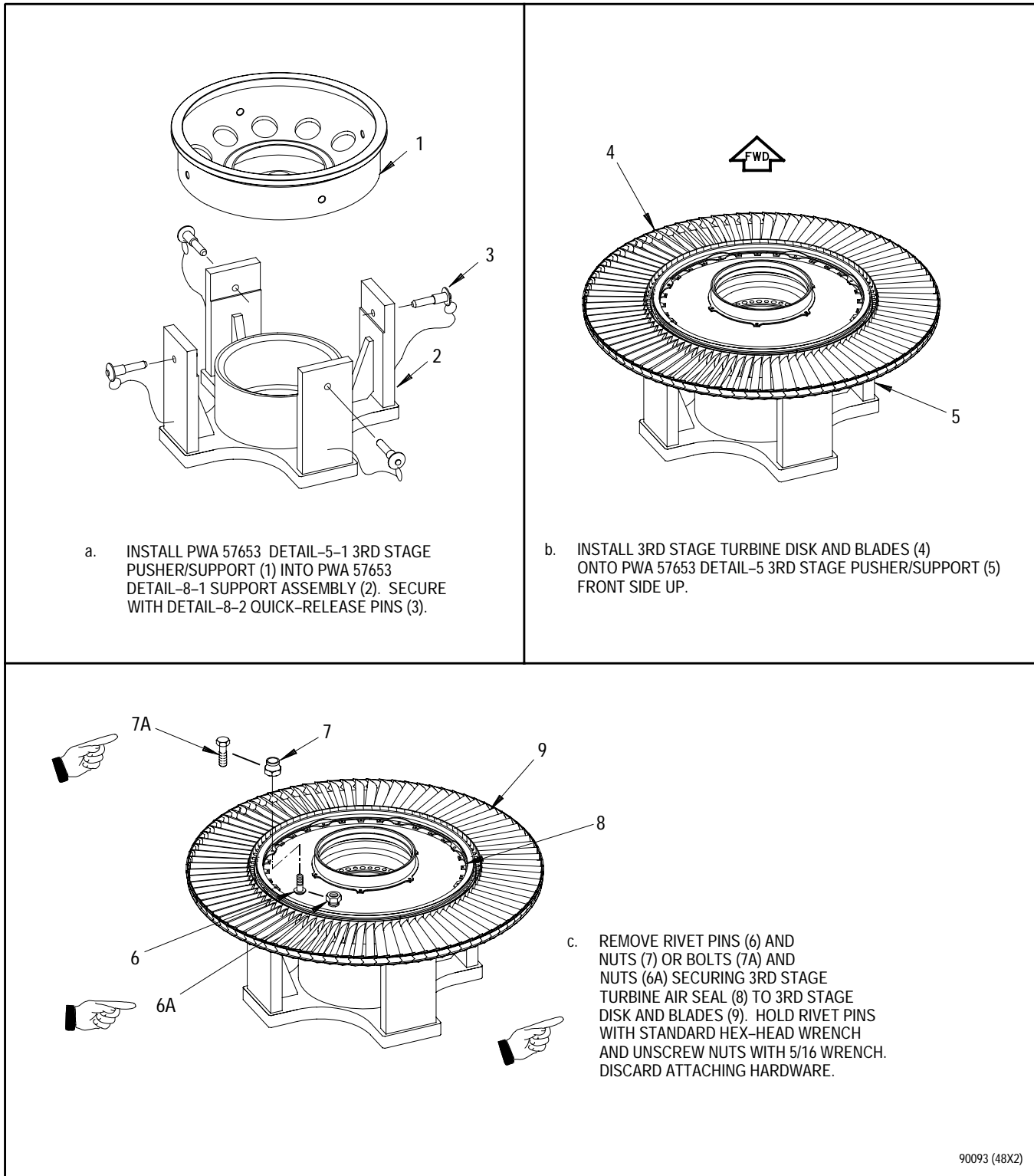
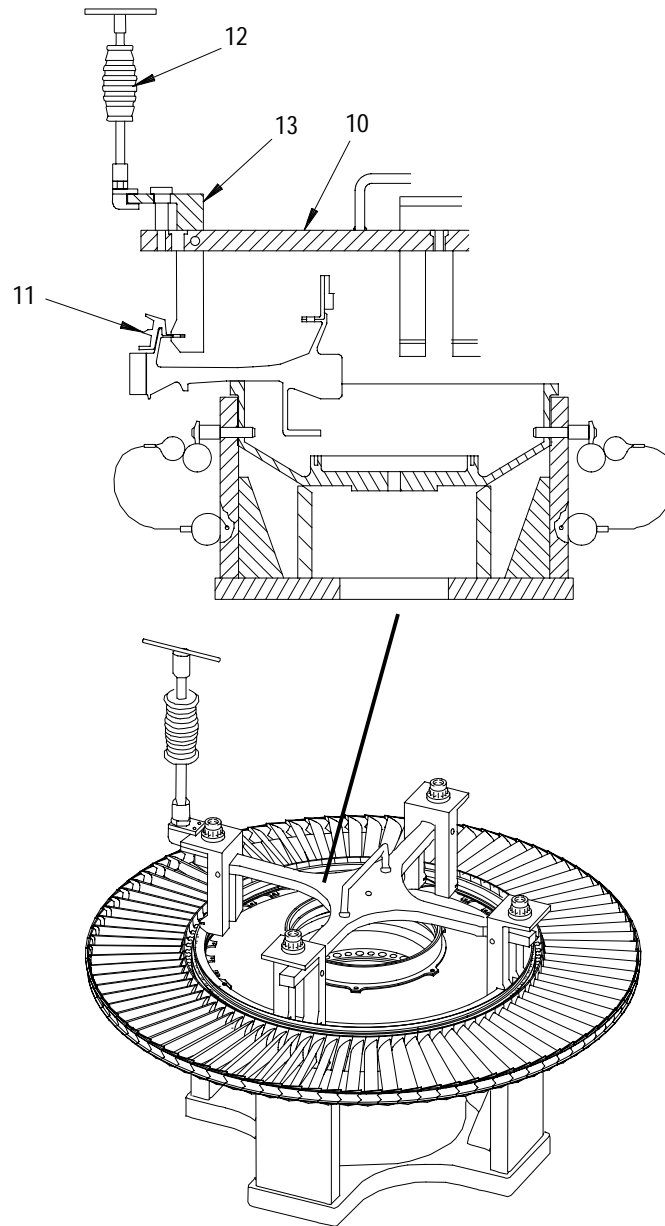


Figure 1. Third Stage Turbine Air Seal - Removal (Sheet 1 of 2)



- d. INSTALL PWA 57653 DETAIL-9-1 3RD STAGE OUTER AIR SEAL PULLER ASSEMBLY (10) ON ID FLANGE OF AIR SEAL (11) AT RIVET HOLE LOCATIONS.
- e. FIT JAWS OF PWA 57600 PULLER (12) ON OUTER FLANGE OF PWA 57653 DETAIL-9 3RD STAGE OUTER AIR SEAL PULLER ASSEMBLY DETAIL-9-2 PULLER (13).
- f. WORK SLIDE HAMMER OF PWA 57600 PULLER. MOVE PULLER CLOCKWISE TO DIFFERENT LOCATIONS ON DETAIL-9 3RD STAGE OUTER AIR SEAL PULLER ASSEMBLY (10) UNTIL AIR SEAL IS LOOSE. REMOVE DETAIL -9 PULLER ASSEMBLY (10). REMOVE AIR SEAL (11).

66149 (48X2)

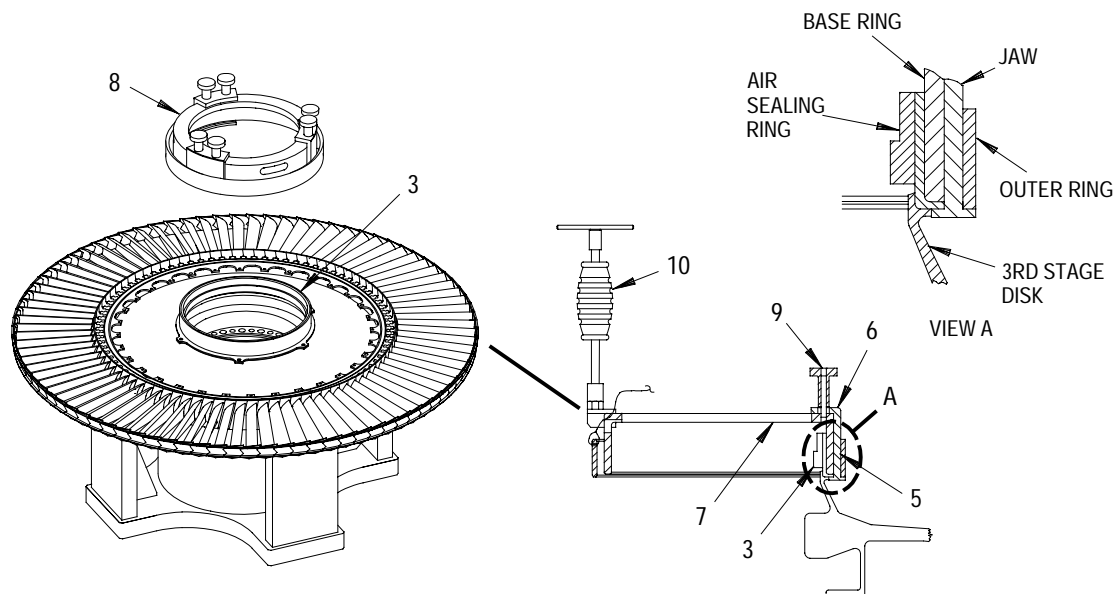
Figure 1. Third Stage Turbine Air Seal - Removal (Sheet 2 of 2)

**4. THIRD STAGE TURBINE AIR SEALING
RING - REMOVAL.**

(See Figure 2.)

- a. Remove 3rd stage turbine air
sealing ring. (See figure 2.)

-
- This diagram shows the 3rd stage pusher assembly in an exploded view. The main components are labeled as follows:
- 1**: The main circular pusher plate with radial fins.
 - 1A**: A small circular component, likely a seal or gasket, located between the pusher plate and the support assembly.
 - 2**: A bolt used to secure the assembly.
 - 2A**: A nut used to secure the assembly.
 - 3**: A ring of small, rectangular components (possibly O-rings or spacers) located around the inner edge of the pusher plate.
 - 4**: The support assembly, which is a base with four legs.
- Additional labels and arrows include:
- FWD**: An arrow pointing upwards, indicating the forward direction.
 - SUPPORT ASSEMBLY REFERENCE**: An arrow pointing to the support assembly (4).
 - 3RD STAGE PUSHER/SUPPORT REFERENCE**: An arrow pointing to the pusher plate (1).



- b. INSTALL PWA 57525 PULLER (8):
 - REMOVE DETAIL-1 OUTER RING (5) FROM DETAIL-2 JAW (6).
 - FIT DETAIL-12 BASE RING (7) ONTO OD OF AIR SEALING RING (3).
 - ENSURE DETAIL-2 JAW (6) ENGAGES FLANGE OF AIR SEALING RING.
 - INSTALL DETAIL-1 OUTER RING (5) OVER DETAIL-2 JAW (6). HAND-TIGHTEN DETAIL-9 THUMBSCREWS (9) TO SECURE PULLER (8) TO AIR SEALING RING.
- c. INSTALL PWA 57600 PULLER (10) THROUGH SLOT IN PWA 57525 PULLER DETAIL-3 BASE RING (7).
- d. WORK SLIDE HAMMER OF PWA 57600 PULLER (10). MOVE PULLER CLOCKWISE TO DIFFERENT LOCATIONS ON PWA 57525 PULLER DETAIL-3 BASE RING (7) UNTIL AIR SEALING RING (3) IS LOOSE.
REMOVE AIR SEALING RING (3).

Figure 2. Third Stage Turbine Air Sealing Ring - Removal

5. THIRD STAGE TURBINE BLADES - REMOVAL.

(See Figure 3.)

NOTE

- All turbine blades shall be same part number. Do not mix blades with different part numbers.
- Blades are replaced in matched moment-weight pairs or in complete sets. When any one blade is replaced, the blade 180 degrees (opposite) away shall also be replaced.
- A matched moment-weight pair consists of two blades which weigh within 0.200 ounce-inch (moment-weight) of each other.
- Blades shall be installed in their original locations.
 - a. Mark blade locations using Colorbrite No. 2101 silver pencil or equivalent. Mark blades clockwise beginning at No. 1 slot. No. 1 slot is located 180 degrees from C mark on tierod bolt flange.
 - b. Retain blades using strap or wire.
 - c. Raise 3rd stage disk and blade assembly from PWA 57653

detail-5-1 3rd stage pusher/support and PWA 57653 detail-8-1 support assembly, then rotate disk to front end down position.

- d. Lower assembly back onto PWA 57653 3rd stage pusher/support and support assembly details, front end down.
- e. Remove strap or wire retaining blades.
- f. Remove 3rd stage blades as follows:
 - (1) Gently tap down on blade roots with fiber or nylon mallet. Continue working around disk to gradually move all blades down until they can all be removed at once.
 - (2) Disengage tip shrouds and remove blades.
 - (3) Mark total accumulated cycles (TAC) on all blades per WP 315 00.
 - (4) Place 3rd stage blades into PWA 71475 fixture, blade tip shrouds down.

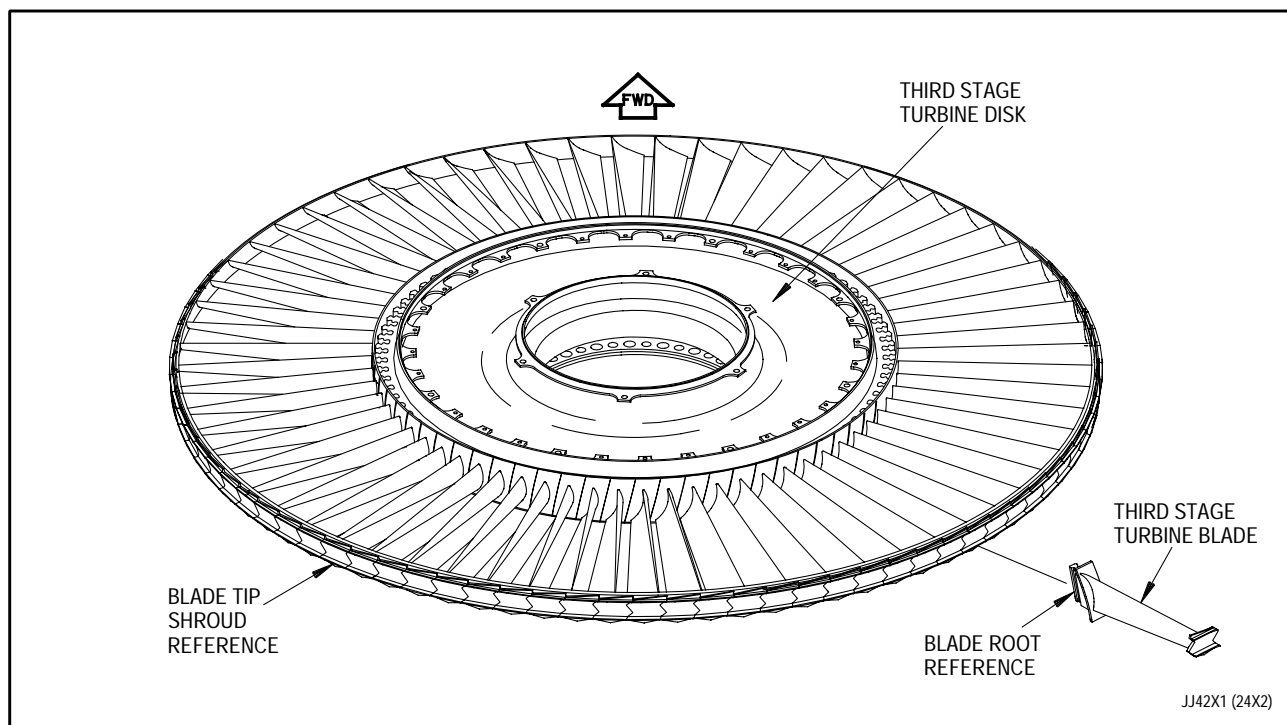


Figure 3. Third Stage Turbine Blades - Removal

6. TURBINE TIERODS - REMOVAL.

(See Figures 4 and 5.)

NOTE

Two methods for tierod removal exist. One uses PWA 57528 assembly tool (part of PWA 57810 tool set), the other uses PWA 57908 support.

- a. Remove tierods using PWA 57528 assembly tool per figure 4.
- b. Remove tierods using PWA 57908 support as follows:
 - (1) Release cam lever(7, figure 5), block(8), locator(9), arm assembly(3), and post assembly(4) from PWA 57908 support.
 - (2) Secure PWA 57908 base(17) to work surface. Place locating ring(14), chamfered OD up, onto base and secure with socket head cap screws(15).
 - (3) Slide support ring(16), chamfered OD up, over locating ring(14) until support ring contacts base.
 - (4) Position 3rd stage turbine disk assembly(13), tierod flange up, onto previously installed support ring(16).
 - (5) Install block(8), and locator(9), as follows:
 - (a) Engage flats of block with flats of tierod nut(12) and engage locator(9) with cone shaped end of tierod(11).

(b) Secure block and locator together by tightening hex head screws(6).

(c) Actuate cam lever(7) to secure block position.

- (6) Install post assembly(4) and arm assembly(3). Align post and arm with locating hole closest to center of base and insert pin assembly(10). Secure using hex head screws(18) and washers(19).
- (7) Position arm assembly(3) to approximate height necessary to remove tierod(11). Secure with hex head screws(20).
- (8) Loosen thumbscrew(5), and slide stud remover(2) in arm assembly(3). Secure by tightening thumbscrew(5).
- (9) Loosen thumbscrew(5), and allow stud remover(2) to slide down and engage tierod(11).
- (10) Insert drive of wrench(1) in top of stud remover(2) and remove tierod(11).
- (11) Loosen cam lever(7) and slide block(8) and locator(9) away from tierod nut. Position 3rd stage turbine disk assembly(13) to next tierod nut.
- (12) Repeat procedure until all tierods have been removed.
- (13) Remove tools from disk.

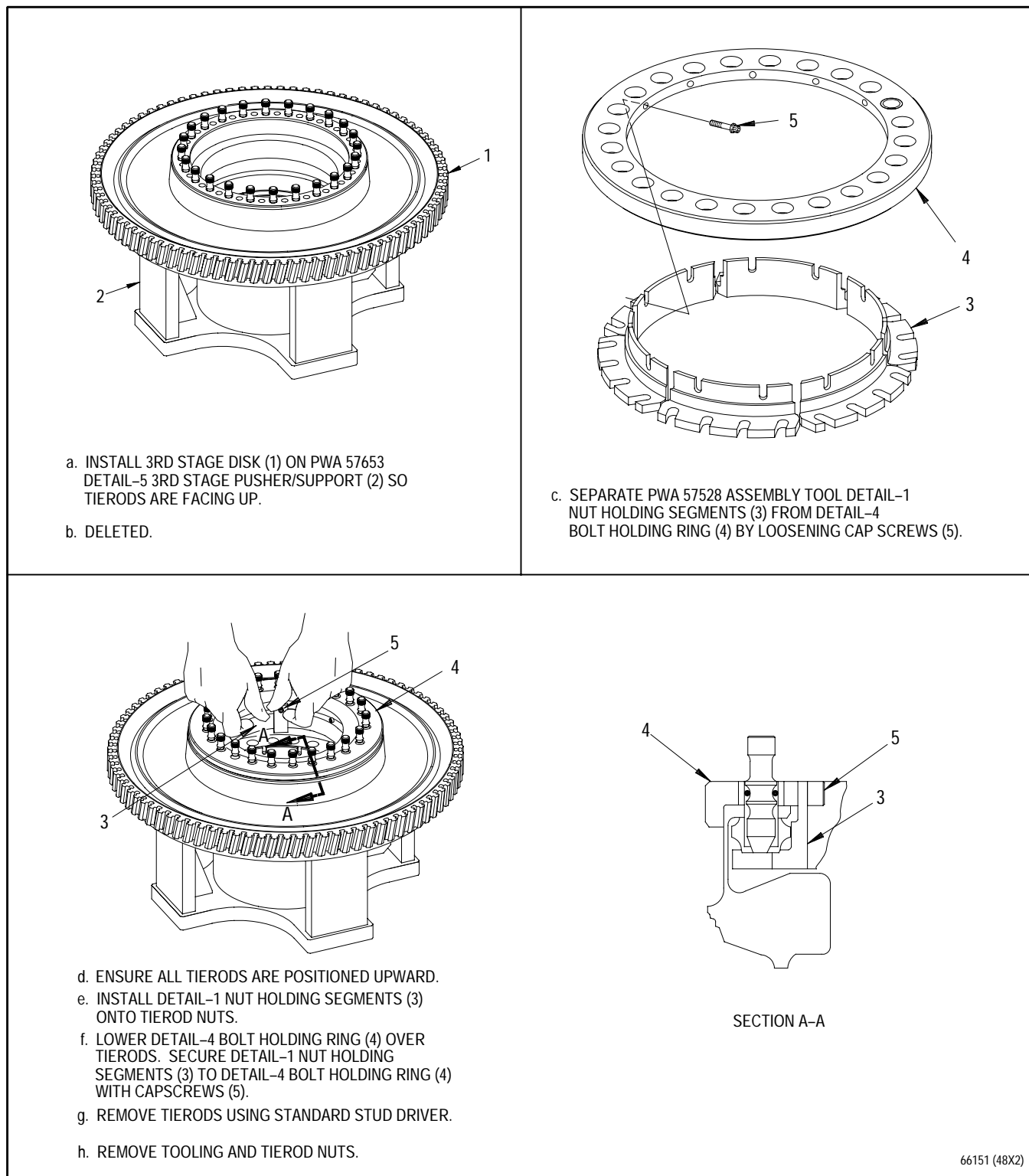
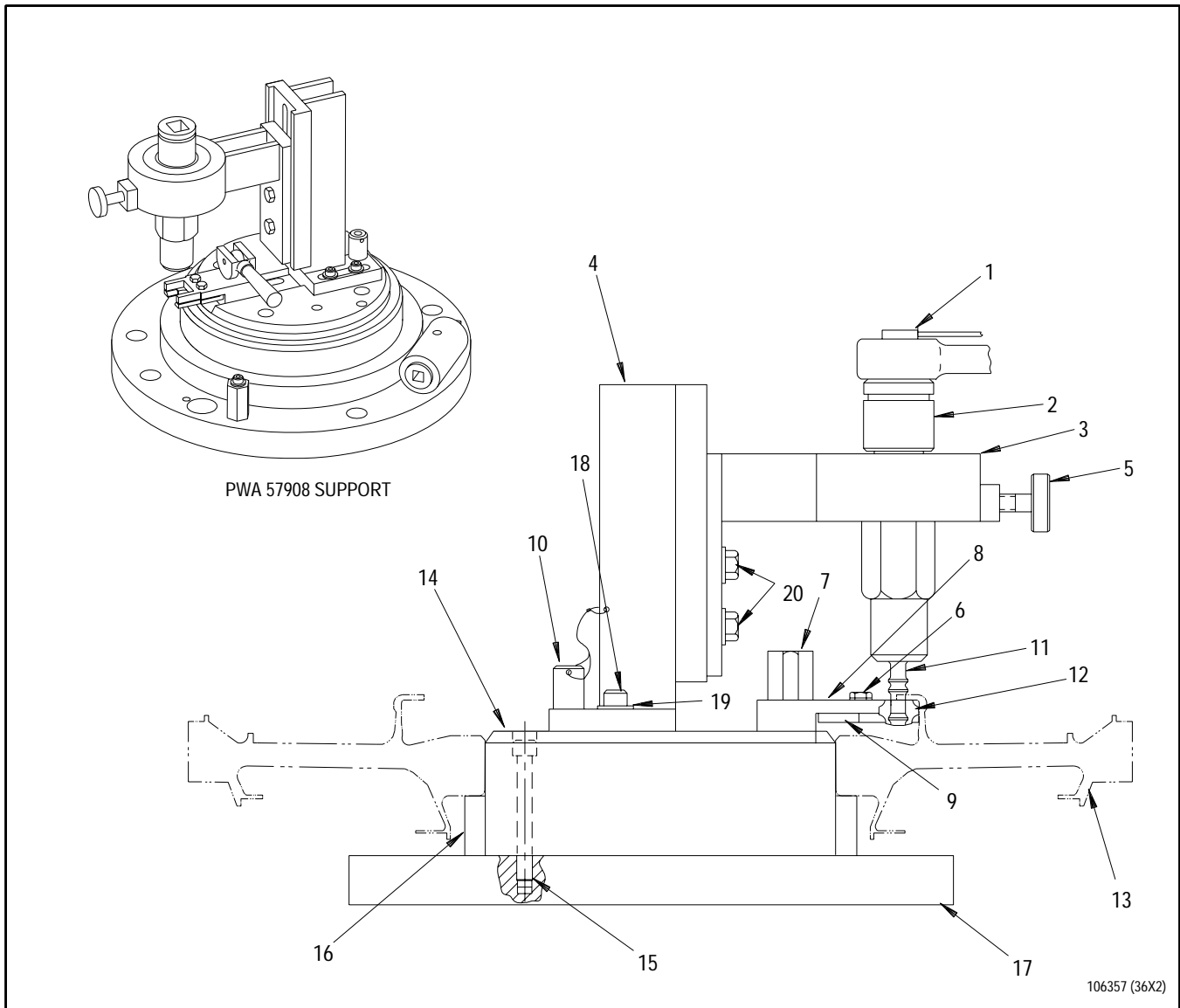


Figure 4. Turbine Tierods - Removal Using PWA 57528 Assembly Tool



- | | |
|---------------------------|-------------------------------------|
| 1. Wrench, 1/2 inch drive | 11. 3rd stage turbine tierod |
| 2. Stud remover | 12. Tierod nut |
| 3. Arm assembly | 13. 3rd stage turbine disk assembly |
| 4. Post assembly | 14. Locating ring |
| 5. Thumbscrew | 15. Socket head cap screw |
| 6. Hex head screw | 16. Support ring |
| 7. Cam lever | 17. Base |
| 8. Block | 18. Hex head screw |
| 9. Locator | 19. Washer |
| 10. Pin assembly | 20. Hex head screws |

Figure 5. Turbine Tierods - Removal Using PWA 57908 Support

WORK PACKAGE

TECHNICAL PROCEDURES

DISK AND BLADES, FOURTH STAGE TURBINE -

DISASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	4 - 5	28	6	23
2 - 3	23				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T.O. No.	Date	Level	Title (ECP No.)
2J-F100229-553	15 Feb 1995	O/I	Modification of PWA 57653 tool set, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 94QC004-1)
2J-F100229(III)-502	15 Feb 1992	O/I	Retrofit of full life 4th stage turbine blade PN 4080704 F100-PW-229 Engine, F15/F16 Aircraft. (ECP 91QA204)
2J-F100229(III)-517	15 Feb 1995	D	Installation of improved durability 4th stage turbine blade PN 4082504, disk PN 4082604, and air seal PN 4082297, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 93QA253R1C1)
2J-F100229(III)-518	15 Feb 1995	O/I	Installation of improved durability 4th stage turbine blade PN 4082504, disk PN 4082604, and air seal PN 4082297, F100-PW-229 Engines, F-15 Aircraft. (ECP 93QA253R1)

CONSUMABLE MATERIALS

Nomenclature

Specification/Vendor Part Number

Pencil (crayon), silver, metal marking (hard)

Colorbrite No. 2101,
or
Color-Tex No. 1843
or
Anadel No. 1936

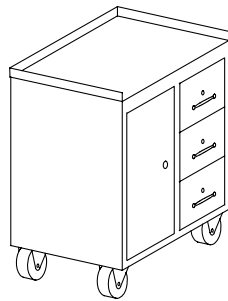
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

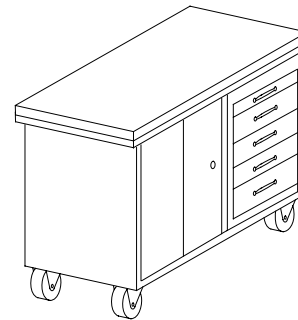
Paragraph	Function - Tool Nomenclature	Tool Number
3	Fourth Stage Turbine Blades - Removal Tool set - fan drive turbine rotor, assembly/disassembly - - - - -	PWA 57810 or PWA 57653
	Fixture, holding - - - - -	PWA 71476

ILLUSTRATED SUPPORT EQUIPMENT



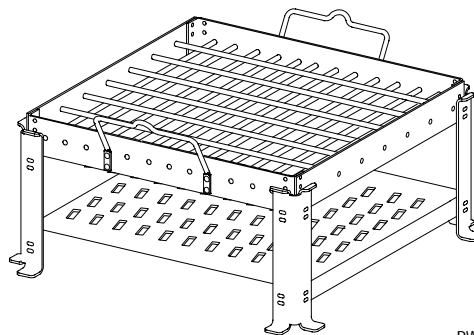
PWA 57653 -C

Figure T1. PWA 57653 Tool Set



PWA 57810 -C

Figure T2. PWA 57810 Tool Set



PWA 71476 -C

Figure T3. PWA 71476 Fixture

1. INTRODUCTION.

- a. This work package contains instructions for disassembly of 4th stage turbine disk and blades.

2. PRELIMINARY INSTRUCTIONS.

- a. If necessary, remove 4th stage disk and blades per WP 021 00.

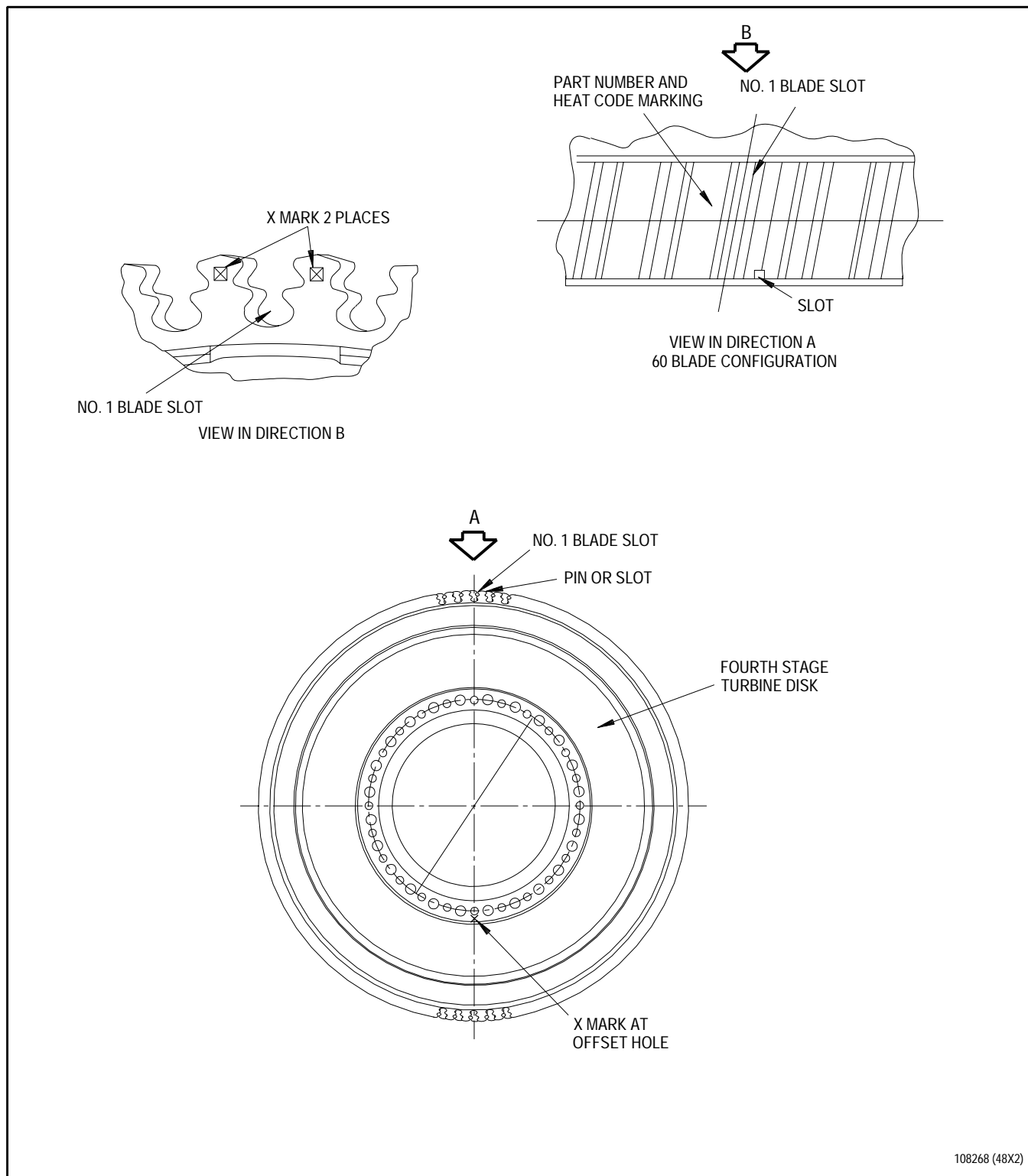
3. FOURTH STAGE TURBINE BLADES - REMOVAL.

(See Figures 1 and 2.)

NOTE

- All turbine blades shall be same part number. Do not mix blades with different part numbers.
- Blades are replaced in matched moment-weight pairs or in complete sets. When any one blade is replaced, the blade 180 degrees (opposite) shall also be replaced.
- A matched moment-weight pair consists of two blades which weigh within 0.200 ounce-inch (moment-weight) of each other.
- When a complete blade set is replaced, install matching blades 180 degrees apart.
- Reinstall blades in their original locations.

- a. Place 4th stage disk and blades, front end up, on bench.
- b. Find No. 1 blade slot.
(See figure 1.)
- c. Number each blade clockwise from No. 1 slot, using Colorbrite No. 2101 silver pencil or equivalent.
- d. Retain blades with a strap or wire to prevent blades from falling out while rotating disk.
- e. Raise 4th stage disk and blades, then rotate it to front end down position.

**Figure 1. Location of No. 1 Blade Slot**

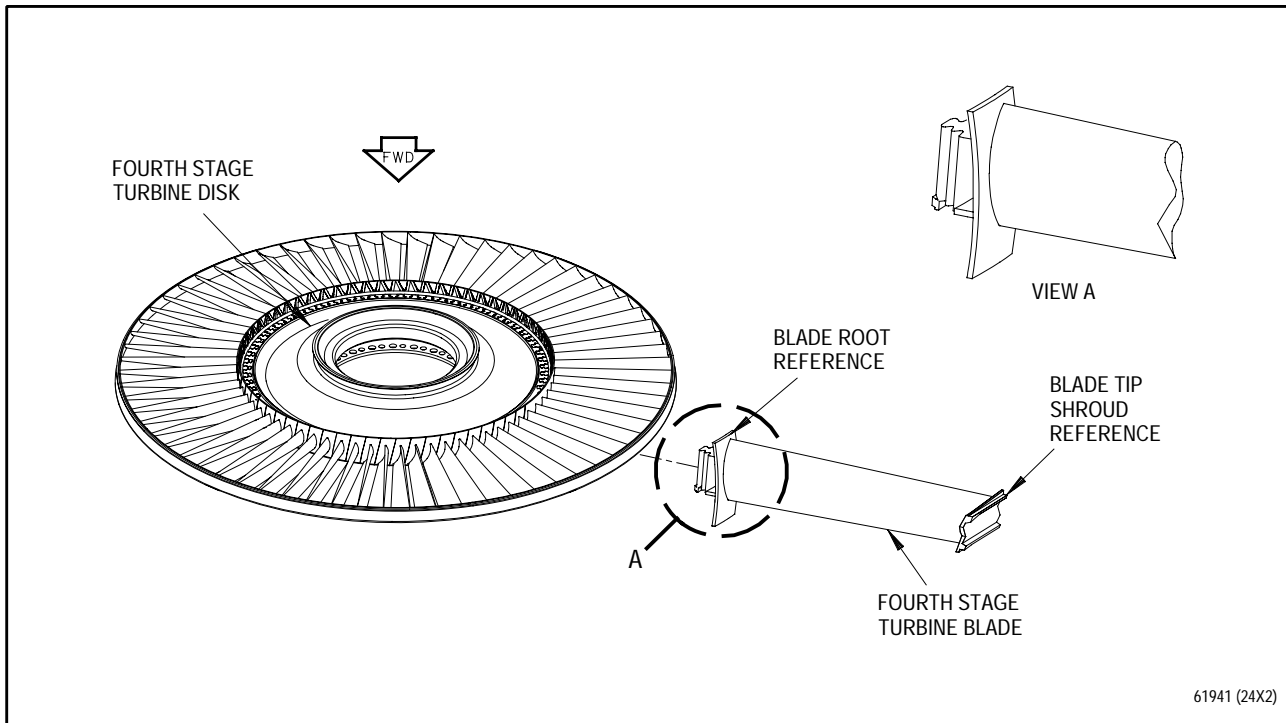


Figure 2. Fourth Stage Turbine Disk and Blades - Disassembly

- f. Lower 4th stage disk and blades, front end down, onto PWA 57653 detail-5 3rd stage pusher/support and detail-8 support assembly (details of PWA 57810 tool set). Secure detail-5 3rd stage pusher/support and detail-8 support assembly with detail-8-2 quick release pins.
 - (3) Disengage tip shrouds and remove blades.
 - (4) Mark total accumulated cycles (TAC) on all blades per WP 315 00.
 - (5) Place 4th stage blades into PWA 71476 fixture, blade tip shrouds down.
- g. Remove 4th stage blades as follows: (See figure 2.)
 - (1) Remove strap or wire securing blades.
 - (2) Gently tap down on blade roots with a fiber or nylon mallet. Keep working around disk to gradually move all blades down until they can all be removed at once.

WORK PACKAGE

TECHNICAL PROCEDURES

CASE ASSEMBLY, TURBINE EXHAUST -

DISASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4					29

REFERENCE MATERIAL REQUIRED

Title	Number
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Disassembly into Subassemblies - - - - -	WP 012 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T.O. No.	Date	Level	Title (ECP No.)
2J-F100229(III)-525	15 Feb 1997	D	Rework of Turbine Exhaust Case and Fourth Turbine Disk; and Installation of New (PN 4082239) Fourth Stage Turbine Brush Seal and Support Assembly, F100-PW-229 Engine, F-15/F-16 Aircraft (ECP 93QA347)

CONSUMABLE MATERIALS

None

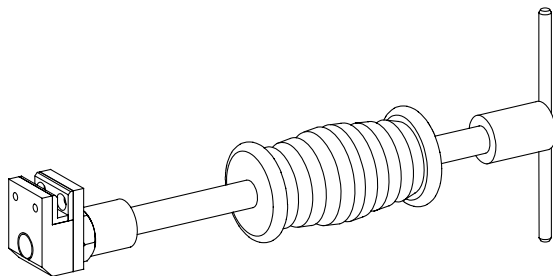
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

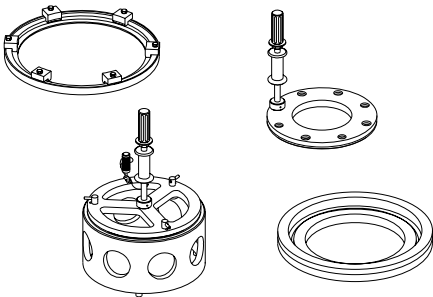
Paragraph	Function - Tool Nomenclature	Tool Number
3	TURBINE EXHAUST CASE ASSEMBLY - DISASSEMBLY	
	PULLER, 4TH STAGE TURBINE AIR SEAL - - - - -	PWA 57600
4	FOURTH STAGE TURBINE BRUSH SEAL AND SUPPORT ASSEMBLY - REMOVAL	
	FIXTURE, BRUSH AND SEAL SUPPORT ASSY 4TH STG TURBINE DISK - - - - -	PWA 57934

ILLUSTRATED SUPPORT EQUIPMENT



PWA 57600 -C

Figure T1. PWA 57600 PULLER



PWA 57934 -C

Figure T2. PWA 57934 FIXTURE

1. INTRODUCTION.

- a. This work package contains instructions for removing the following parts from the turbine exhaust case assembly:
 - Fourth stage turbine brush seal and support assembly
 - Fourth stage turbine air sealing ring assembly
 - No. 5 bearing seal assembly
 - Front and rear turbine exhaust duct assemblies

2. PRELIMINARY INSTRUCTIONS.

- a. If necessary, remove turbine exhaust case per WP 012 00.

3. TURBINE EXHAUST CASE ASSEMBLY - DISASSEMBLY.

(See Figure 1.)

NOTE

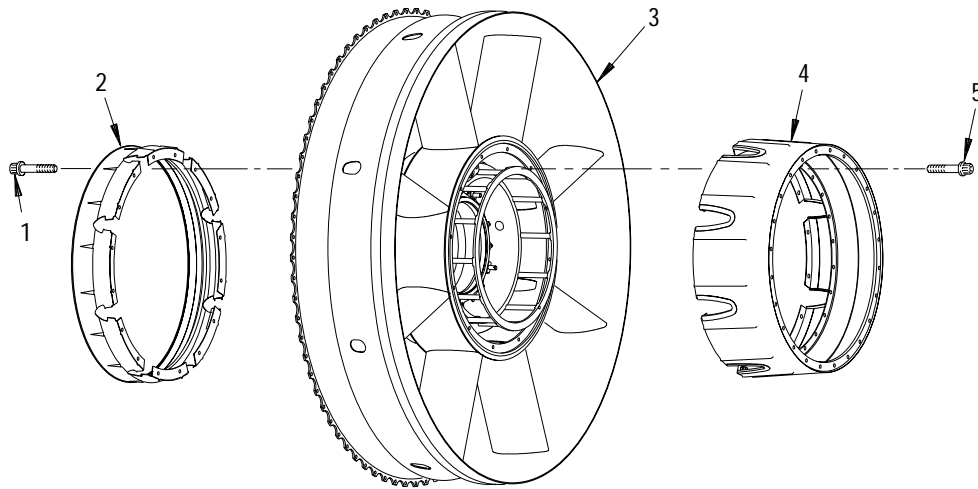
Two turbine exhaust case assembly configurations exist. One configuration includes a 4th stage turbine brush seal and support assembly(10, Figure 1). The other includes a 4th stage turbine air sealing ring assembly(11).

- a. Disassemble turbine exhaust case assembly per figure 1.

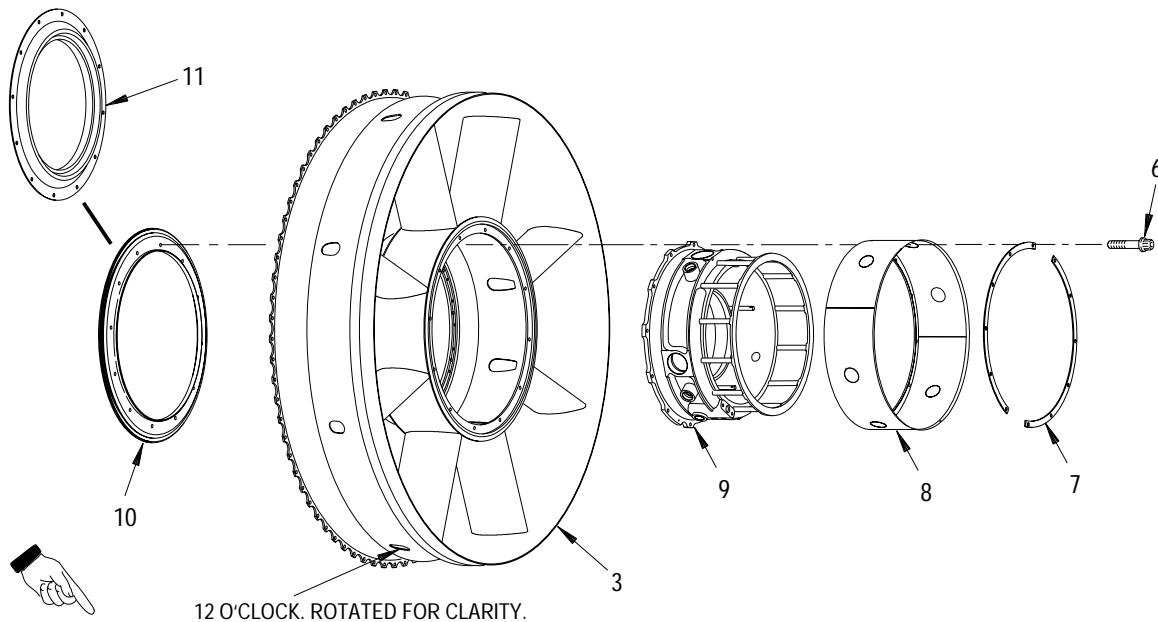
4. FOURTH STAGE TURBINE BRUSH SEAL AND SUPPORT ASSEMBLY - REMOVAL.

(See Figure 1.)

- a. Place turbine exhaust case on padded work bench with rear end down.
- b. Install PWA 57934 fixture, ring detail -1 in center of turbine exhaust case. Small diameter of drift plate fits on inside diameter of brush seal and support assembly.
- c. Install slide hammer detail -5 in outside rim holes of drift and alternately drift brush seal and support assembly from turbine exhaust case.
- d. Remove tooling.



- a. POSITION TURBINE EXHAUST CASE ASSEMBLY (3) SO BOTH SIDES ARE ACCESSIBLE.
- b. REMOVE BOLTS (1). REMOVE FRONT TURBINE EXHAUST DUCT ASSEMBLY (2).
- c. REMOVE BOLTS (5). REMOVE REAR TURBINE EXHAUST DUCT ASSEMBLY (4) FROM TURBINE EXHAUST CASE ASSEMBLY (3).



- d. REMOVE BOLTS (6). REMOVE SPACER (7), HEAT SHIELD (8) AND 4TH STAGE TURBINE BRUSH SEAL AND SUPPORT ASSEMBLY (10) USING PWA 57934 FIXTURE OR 4TH STAGE TURBINE AIR SEALING RING ASSEMBLY (11) FROM TURBINE EXHAUST CASE ASSEMBLY (3).
- e. POSITION BEVELED EDGE OF HEAT SHIELDS (8) ABOVE ID FLANGE OF REAR EXHAUST CASE ASSEMBLY (3) TO ENSURE CLEARANCE.
- f. REMOVE NO. 5 BEARING SEAL ASSEMBLY (9) AND HEAT SHIELD (8) AND SPACERS (7) TOGETHER USING PWA 57600 PULLER.

109830 (48X2)

Figure 1. Turbine Exhaust Case Assembly - Disassembly

WORK PACKAGE

TECHNICAL PROCEDURES

SUPPORT ASSEMBLY, NO. 5 BEARING SEAL -

DISASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	14	4	14	7	0
2	11	5 - 6	11	8 Blank	0
3	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures	T.O. 2-1-111

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

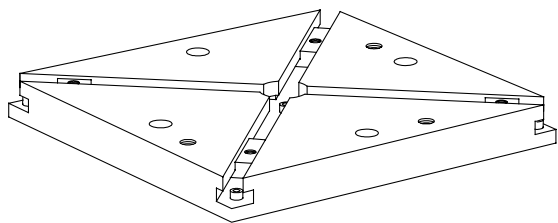
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

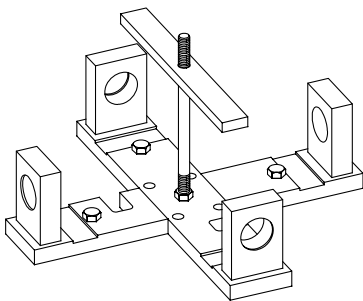
Paragraph	Function - Tool Nomenclature	Tool Number
4	Ball Socket Seats and Insert - Removal	
	Adapter, Holding	PWA 21500
	Adapter, No. 5 bearing seal support	PWA 57760
	Puller, No. 5 bearing check valve	PWA 57829

ILLUSTRATED SUPPORT EQUIPMENT



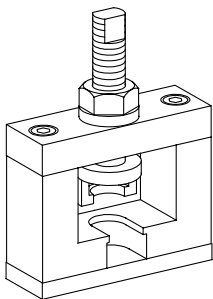
PWA 21500 -C

Figure T1. PWA 21500 Adapter



PWA 57760 -C

Figure T2. PWA 57760 Adapter



PWA 57829 -C

Figure T3. PWA 57829 Puller

1. INTRODUCTION.

- a. This work package contains instructions for disassembly of No. 5 bearing seal support assembly.

2. PRELIMINARY INSTRUCTIONS.

- a. If necessary, remove No. 5 bearing seal support assembly per T.O. 2J-F100-53-9, WP 024 00.

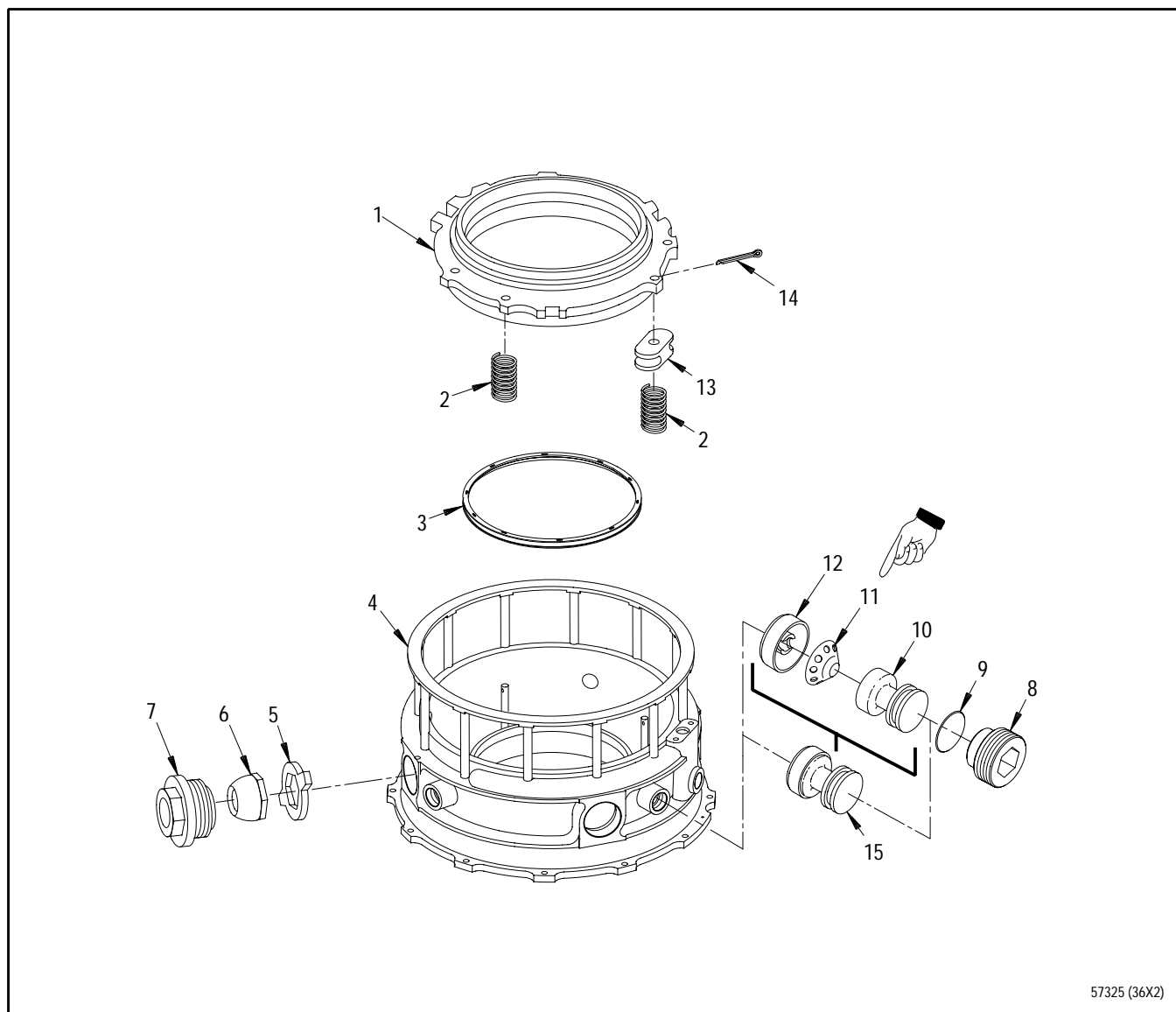
**3. NO. 5 BEARING FACE SEAL (REAR SEAL)
ASSEMBLY - REMOVAL.**

(See Figure 1.)



Be careful when removing and handling No. 5 bearing face seal. Carbon seal is easily damaged.

- a. Remove protector (if installed) from seal support.
- b. Carefully press down on face seal(1, figure 1) and remove cotter pins(14). Discard cotter pins(14).
- c. Remove face seal(1), springs(2) and spring seats(13) from seal support(4). Discard springs(2).
- d. For local (in-house) handling; place seal between two pieces of styrofoam and wrap with tape. Place seal in a cardboard box.
- e. For shipping, place seal in a cardboard box with cardboard collar around carbon portion of seal. Refer to T.O. 2-1-111.
- f. Remove metal seal ring(3) from seal support(4). Discard seal ring(3).



57325 (36X2)

- | | |
|-------------------------------------|------------------------------|
| 1. No. 5 bearing face seal assembly | 9. Packing |
| 2. Spring | 10. Oil check valve seat |
| 3. Metal seal ring | 11. Oil check valve |
| 4. No. 5 bearing support | 12. Oil check valve stop |
| 5. Key washer | 13. Spring seat |
| 6. Rod ball end | 14. Cotter pin |
| 7. Ball socket seat | 15. Oil check valve assembly |
| 8. Oil check valve cap | |

Figure 1. No. 5 Bearing Seal Support Assembly - Disassembly

4. BALL SOCKET SEATS AND OIL CHECK VALVE - REMOVAL.

(See figure 1 and Figure 2.)

NOTE

Do not discard key washers.

a. Remove ball socket seats and oil check valve assemblies, as required. (See figure 2.)

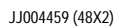
b. Disassemble oil check valve assembly(15, figure 1) as follows:

- (1) Insert oil check valve assembly into PWA 57829 puller with oil check valve stop(12) facing down.

- (2) Ensure oil check valve seat(10) is positioned fully into upper jaw of puller.

- (3) Turn nut at top of puller clockwise while holding threaded stud using wrench on flats to separate valve stop from valve seat.

- (4) Remove valve seat(10), check valve(11), and valve stop(12) from puller.



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WORK PACKAGE

TECHNICAL PROCEDURES

SEAT - TURBINE SHAFT LOCK -

REMOVAL

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	13	5	13	6 Blank	0
3 - 4	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

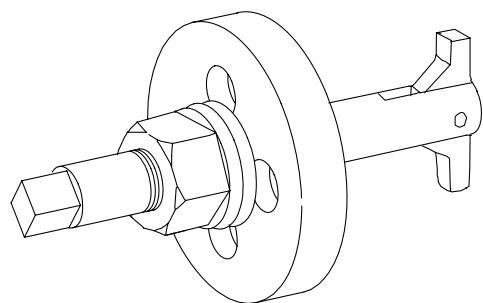
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

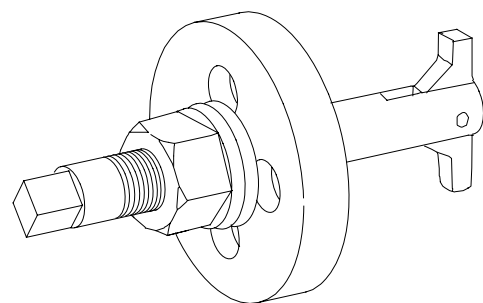
Paragraph	Function - Tool Nomenclature	Tool Number
2	Turbine Shaft Lock Seat - Removal	
	Puller, turbine shaft lock seat - - - - -	PWA 56583 or PWA 51063

ILLUSTRATED SUPPORT EQUIPMENT



PWA 51063 -C

Figure T1. PWA 51063 Puller



PWA 56583 -C

Figure T2. PWA 56583 Puller

1. INTRODUCTION.

- a. This work package contains instructions for removal of turbine shaft lock seat.

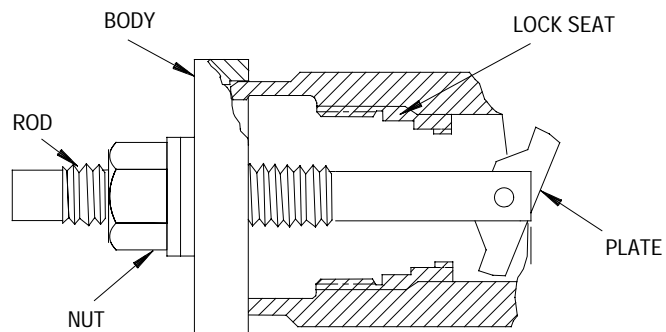
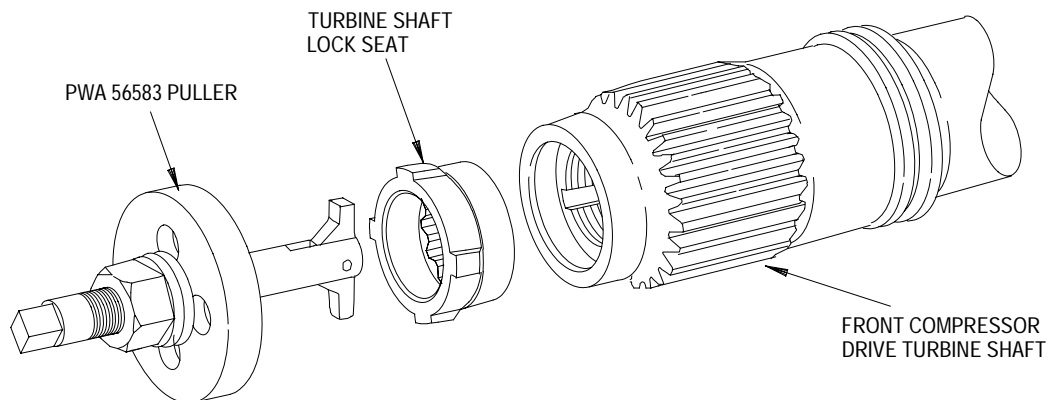
T.O. 2J-F100-53-9

WP 026 00

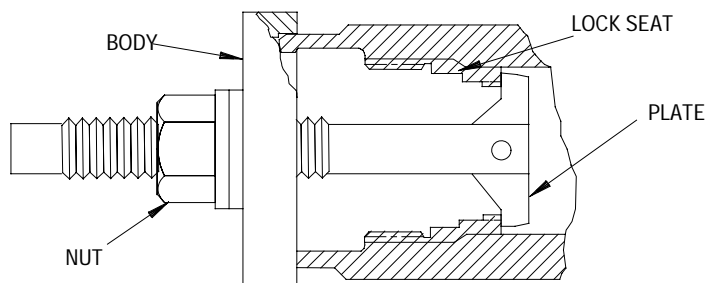
2. TURBINE SHAFT LOCK SEAT - REMOVAL.

(See Figure 1.)

- a. Remove turbine shaft lock seat.
(See figure 1.)



- a. TURN ROD OF PWA 56583 PULLER SO THAT PLATE WILL GO PAST LOCK SEAT. INSERT PULLER INTO TURBINE SHAFT. FIT BODY OF PULLER OVER END OF TURBINE SHAFT.



- b. TIGHTEN NUT SO THAT PLATE FITS AGAINST LOCK SEAT. CONTINUE TIGHTENING NUT TO PULL LOCK SEAT FROM SHAFT.

64106 (48X2)

Figure 1. Turbine Shaft Lock Seat - Removal

WORK PACKAGE

TECHNICAL PROCEDURES

TURBINE STATOR ASSEMBLY, THIRD STAGE -

DISASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	14	4 - 5	14	6 Blank	0
2 - 3	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature

Specification/Vendor Part Number

Pencil (crayon), silver,
metal marking (hard)

Colorbrite No. 2101
or
Color-Tex No. 1843
or
Anadel No. 1936

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for disassembly of the 3rd stage turbine stator assembly.

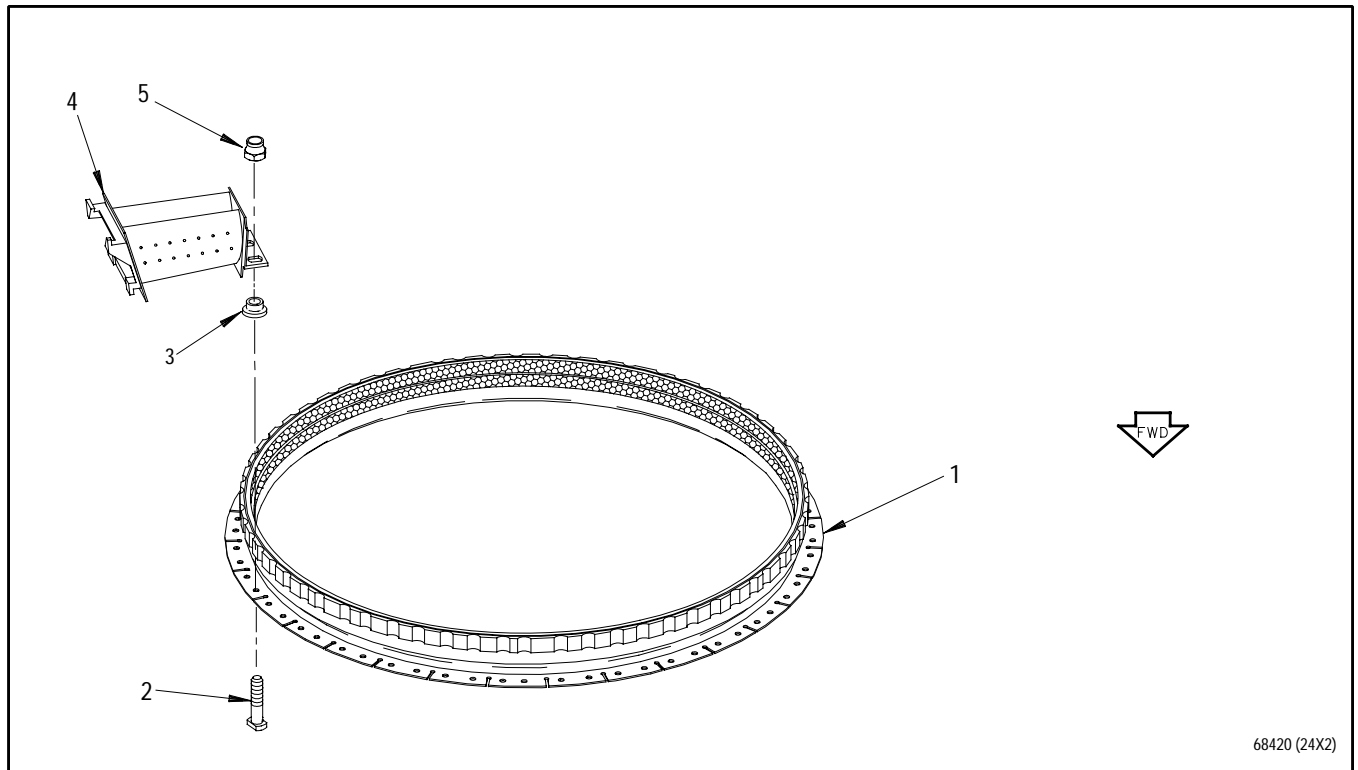
2. PRELIMINARY INSTRUCTIONS.

- a. If necessary, remove 3rd stage turbine stator assembly per T.O. 2J-F100-53-9, WP 021 00.

**3. THIRD STAGE TURBINE STATOR
ASSEMBLY - DISASSEMBLY.**

(See Figure 1.)

- a. Place 3rd stage turbine stator assembly front face up on work bench.
- b. Mark location of 3rd stage turbine stator vanes(4, figure 1) using Colorbrite No. 2101 silver pencil or equivalent. Mark vanes clockwise, beginning with vane located at X mark adjacent to bolt hole in 3rd stage turbine air sealing ring assembly(1).
- c. Rotate 3rd stage turbine stator assembly to front end down position.
- d. Remove nuts(5) and rivet pins(2). Discard nuts and rivet pins.
- e. Remove sleeve spacers(3).
- f. Remove 3rd stage turbine stator vanes(4) from air sealing ring assembly(1).



1. Third stage turbine air sealing ring assembly
2. Rivet pins
3. Sleeve spacers
4. Third stage turbine stator vanes
5. Nuts

Figure 1. Third Stage Turbine Stator Assembly - Disassembly

WORK PACKAGE

TECHNICAL PROCEDURES

TURBINE STATOR ASSEMBLY, FOURTH STAGE -

DISASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	14	3	14	4 Blank	0
2	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature

Specification/Vendor Part Number

Pencil (crayon), silver,
metal marking (hard)

Colorbrite No. 2101
or
Anadel No. 1936
or
Color-Tex No. 1843

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for disassembly of 4th stage turbine stator assembly.

- b. Mark location of 4th stage turbine stator vanes(2) using Colorbrite No. 2101 silver pencil or equivalent.

- c. Remove and discard nuts(1) and rivet pins(4).

2. PRELIMINARY INSTRUCTIONS.

- a. If necessary, remove 4th stage turbine stator assembly per WP 021 00.

NOTE

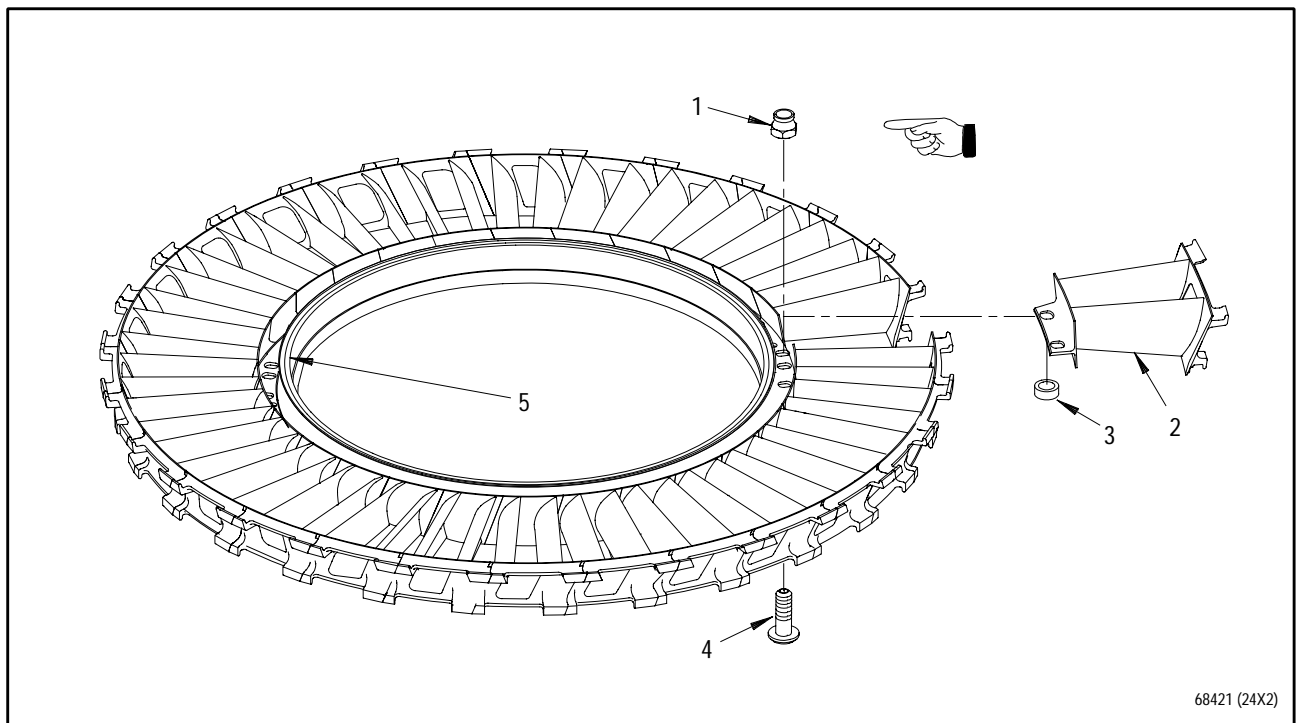
Sleeve spacers will fall from stator vane as vane is removed from 4th stage turbine air sealing ring assembly.

3. FOURTH STAGE TURBINE STATOR ASSEMBLY - DISASSEMBLY.

(See Figure 1.)

- a. Place 4th stage turbine stator assembly front face up on work bench.

- d. Remove 4th stage turbine stator vanes(2) and sleeve spacers(3) from 4th stage turbine air sealing ring assembly.



1. Nuts
2. Fourth stage turbine stator vanes
3. Sleeve spacers
4. Rivet pins
5. Fourth stage turbine air sealing ring assembly

Figure 1. Fourth Stage Turbine Stator Assembly - Disassembly

WORK PACKAGE

TECHNICAL PROCEDURES

**SUPPORT ASSEMBLY - NO. 5 BEARING INNER, AND
NO. 5 BEARING INNER RACE AND ROLLERS -**

DISASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	16	2 - 3	0	4 - 6	16

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Oil, lubricating	MIL-L-7808

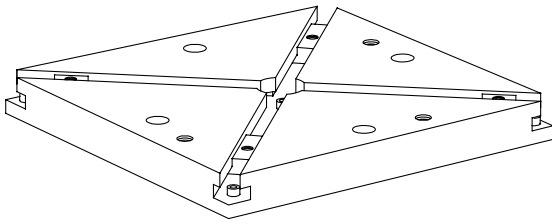
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

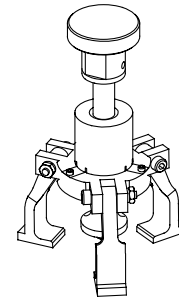
Paragraph	Function - Tool Nomenclature	Tool Number
3	No. 5 Bearing Inner Race and Rollers - Removal From No. 5 Bearing Inner Support Assembly	
	Adapter, Holding - - - - -	PWA 21500
	Puller, No. 5 roller bearing (part of PWA 57658 tool set) - - - - -	PWA 57645
	Torque Fixture, No. 5 bearing retaining nut (part of PWA 57658 tool set) - - - - -	PWA 57655

ILLUSTRATED SUPPORT EQUIPMENT



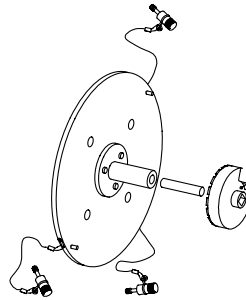
PWA 21500 -C

Figure T1. PWA 21500 Adapter



PWA 57645 -C

Figure T2. PWA 57645 Puller



8371

Figure T3. PWA 57655 Torque Fixture

1. INTRODUCTION.

- a. This work package contains instructions for removing No. 5 bearing inner race and rollers from No. 5 bearing inner support assembly.

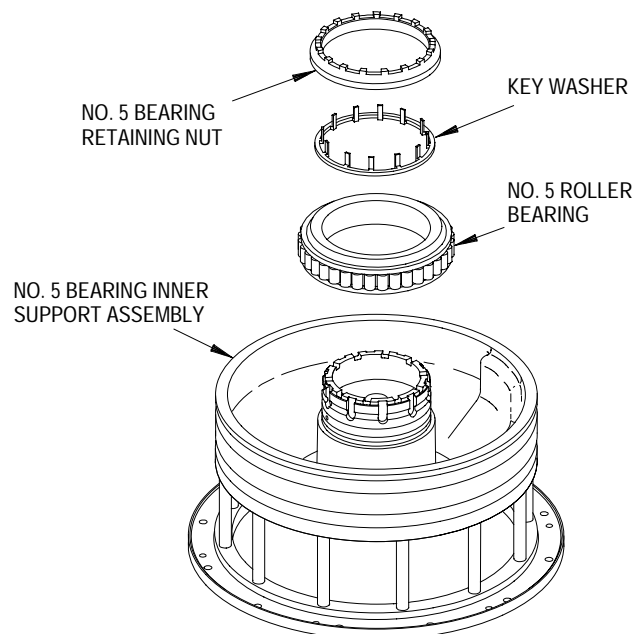
2. PRELIMINARY INSTRUCTIONS.

- a. Remove No. 5 bearing inner support assembly and inner race and rollers as an assembly per WP 012 00.

3. NO. 5 BEARING INNER RACE AND ROLLERS - REMOVAL FROM NO. 5 BEARING INNER SUPPORT ASSEMBLY.

(See Figure 1.)

- a. Remove No. 5 bearing inner race and rollers from No. 5 bearing inner support assembly.
(See figure 1.)



JJ100 (24X2)

**Figure 1. No. 5 Bearing Inner Race and Rollers - Removal From No. 5 Bearing Inner Support Assembly
(Sheet 1 of 3)**

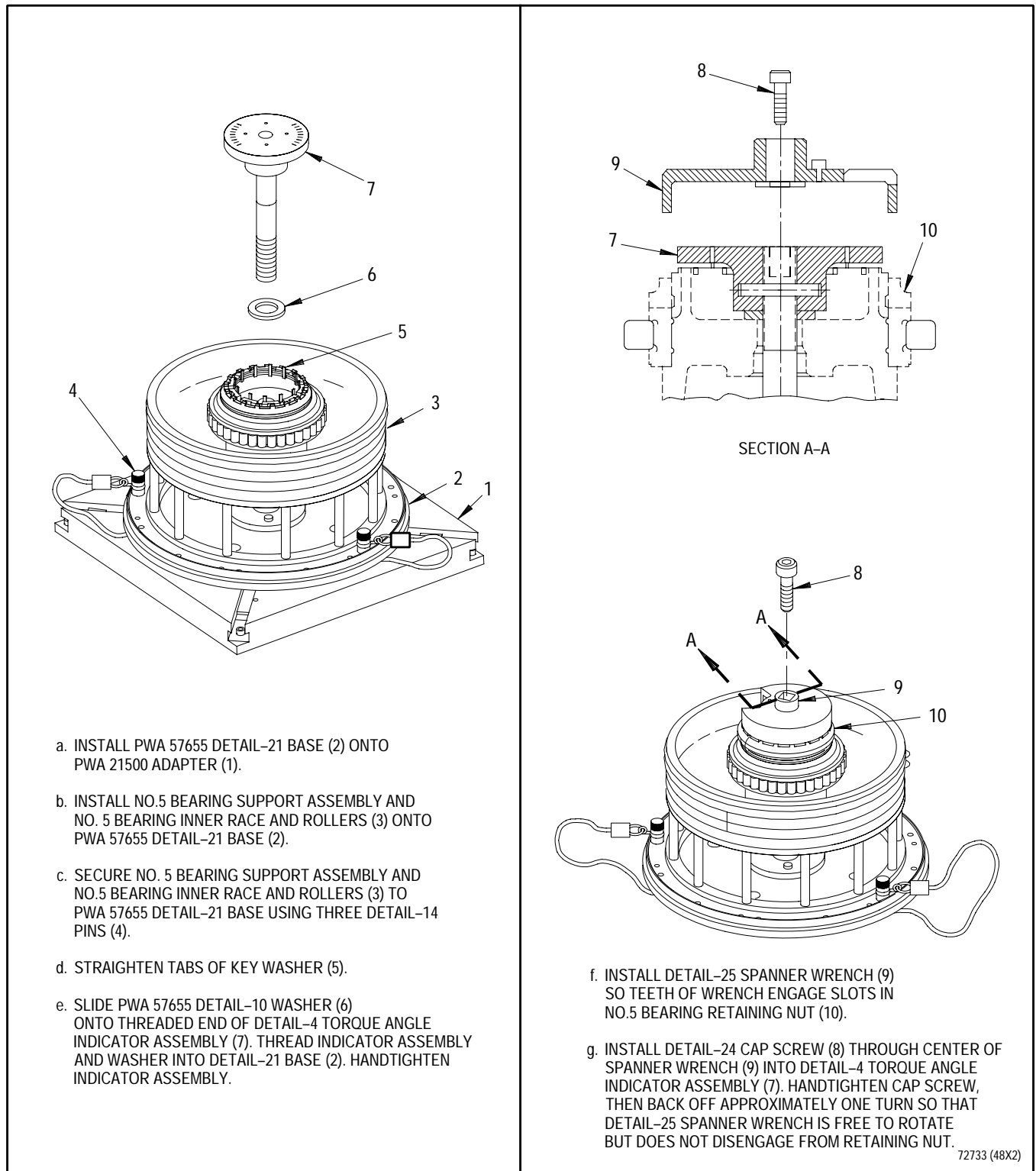
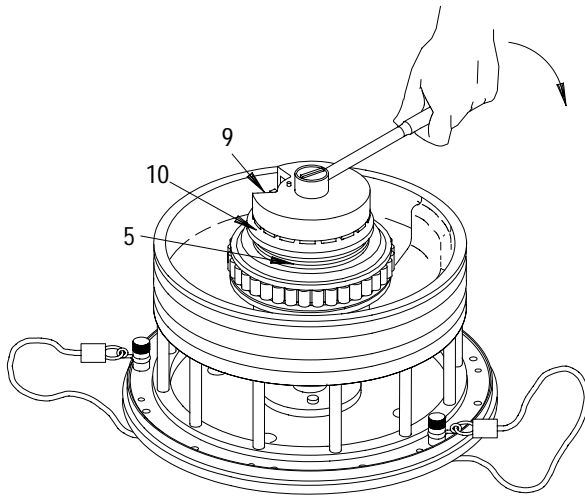
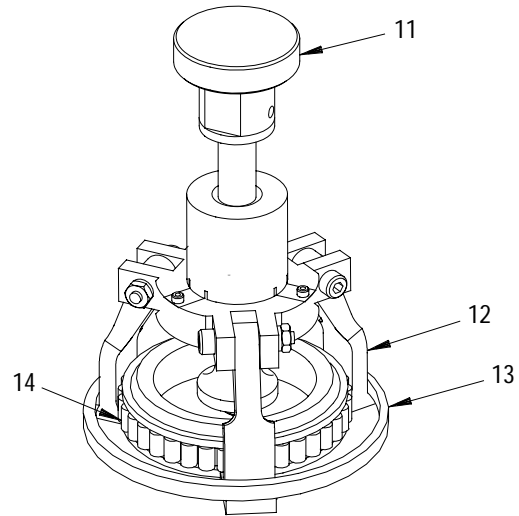


Figure 1. No. 5 Bearing Inner Race and Rollers - Removal From No. 5 Bearing Inner Support Assembly (Sheet 2 of 3)

**NOTE**

NO. 5 BEARING RETAINING NUT HAS LEFT-HAND THREAD.

- h. BREAK TORQUE ON RETAINING NUT (10) USING 1/2 INCH DRIVE RATCHET OR BREAKER BAR. APPLY FORCE IN CLOCKWISE DIRECTION. BACK OFF DETAIL-24 CAP SCREW (8) AS REQUIRED TO ALLOW SPANNER WRENCH (9) TO ROTATE FREELY AS RETAINING NUT IS LOOSENED.
- i. REMOVE DETAIL-24 CAP SCREW (8), DETAIL-25 SPANNER WRENCH (9), RETAINING NUT (10) AND KEY WASHER (5).



- j. INSTALL PWA 57645 PULLER SO DETAIL-2 JAWS (12) ENGAGE INNER RACE OF NO.5 BEARING (14). SLIDE DETAIL-3 RING (13) OVER JAWS. TURN KNOB (11) TO REMOVE INNER RACE AND ROLLERS OF NO.5 BEARING (14). REMOVE INNER RACE AND ROLLERS FROM PULLER.

- k. COAT INNER RACE AND ROLLERS WITH MIL-L-7808 OIL AND STORE IN PROTECTIVE CONTAINER.
- l. REMOVE NO. 5 BEARING SUPPORT ASSEMBLY (3) FROM PWA 57655 DETAIL-21 BASE (2).

72734 (36X2)

Figure 1. No. 5 Bearing Inner Race and Rollers - Removal From No. 5 Bearing Inner Support Assembly (Sheet 3 of 3)

WORK PACKAGE

TECHNICAL PROCEDURES

SHAFT ASSEMBLY, FRONT COMPRESSOR DRIVE TURBINE -

DISASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	.	.	.	6	.
4 - 5	.	.	.	0	.
6 - 8	.	.	.	6	.

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	No. 5 Bearing Plug - Removal	
	Puller, No. 5 bearing plug from shaft (alternate to PWA 50945) - - - - -	PWA 53876
	Pump, Hydraulic - - - - -	PWA 55380
3	Turbine Shaft Front and Rear Stiffener and Balance Weight - Removal	
	Extension Wrench, counterweight bolt - - - - -	PWA 52790
		or
		SAALC X8620338
	Puller, Low turbine shaft stiffeners - - - - -	PWA 56505
		or
		PWA 50950
	Stiffener Remover - - - - -	SAALC X8750309
4	No. 5 Bearing Heat Shield - Removal	
	Puller, Rear heat shield low turbine shaft - - - -	PWA 52616
	Pump, Hydraulic - - - - -	PWA 55380

ILLUSTRATED SUPPORT EQUIPMENT

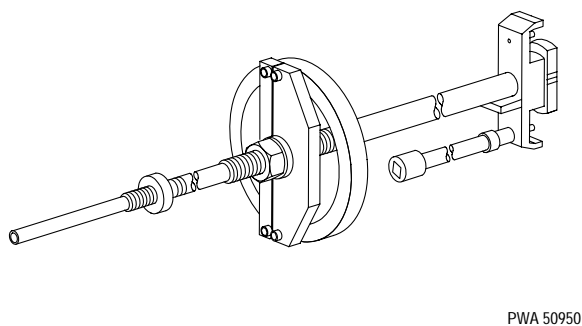


Figure T1. PWA 50950 Puller

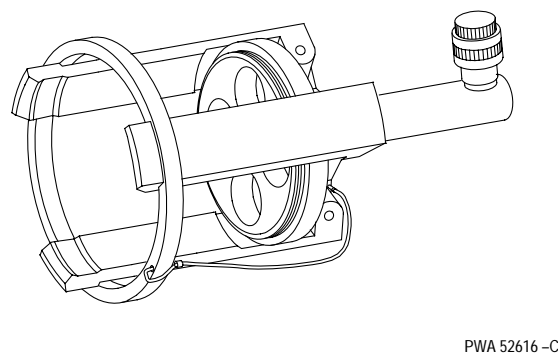
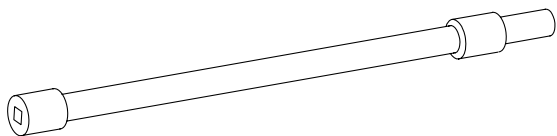


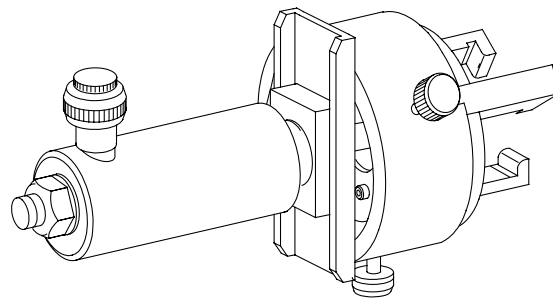
Figure T2. PWA 52616 Puller

ILLUSTRATED SUPPORT EQUIPMENT (continued)



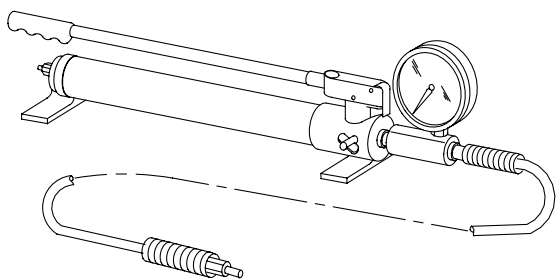
PWA 52790 -C

Figure T3. PWA 52790 Wrench Extension



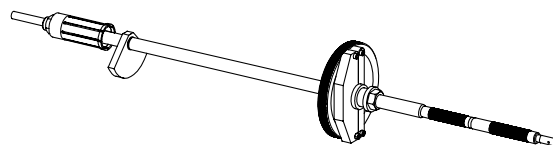
PWA 53876 -C

Figure T4. PWA 53876 Puller



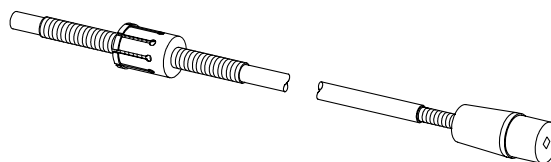
PWA 55380 -C

Figure T5. PWA 55380 Pump



PWA 56505 -C

Figure T6. PWA 56505 Puller



G1487

Figure T7. SAALC X8750309 Stiffener Remover

1. INTRODUCTION.

- a. This work package contains instructions for removal of turbine shaft, front, and rear stiffeners, balance weight, No. 5 bearing plug and heat shield.

2. NO. 5 BEARING PLUG - REMOVAL.

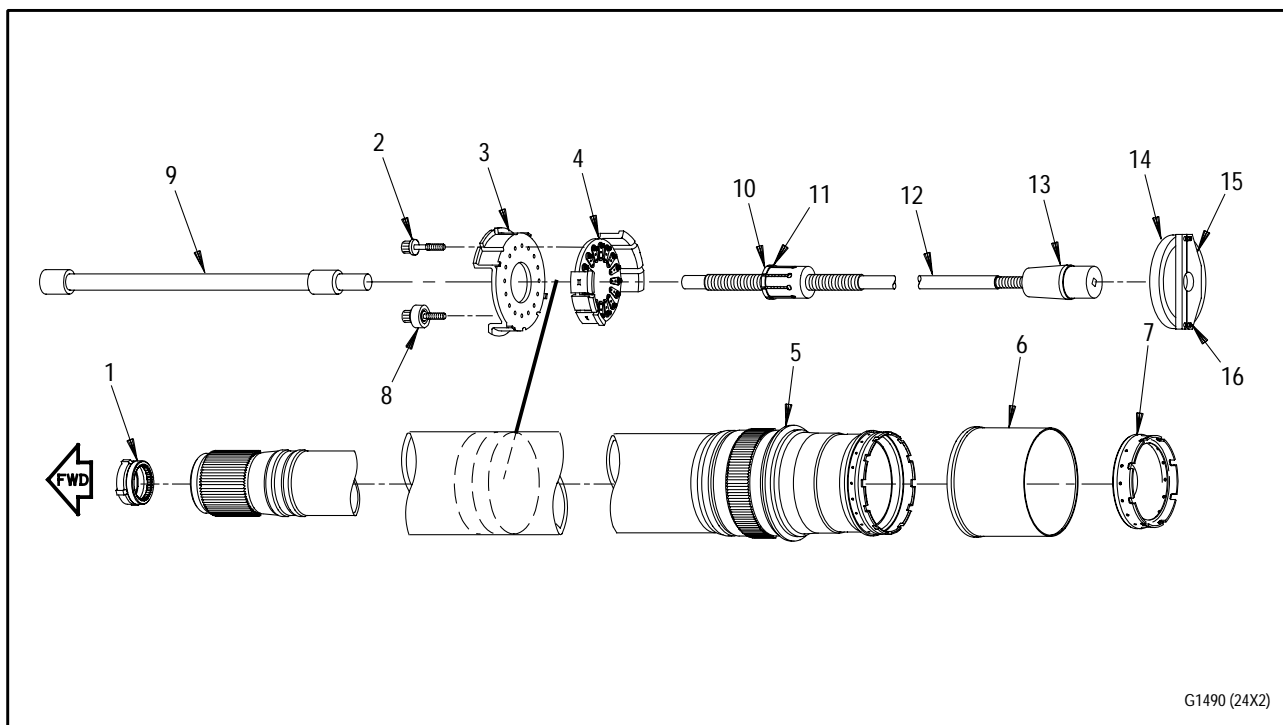
(See Figure 1.)

- a. Remove No. 5 bearing plug(7, figure 1) from ID of front compressor drive turbine shaft as follows:
 - (1) Install PWA 53876 puller on rear of shaft and adjust three legs to locate under ID flange of plug.
 - (2) Lock legs in position.
 - (3) Attach PWA 55380 pump to puller.
 - (4) Actuate pump and unseat plug.
- b. Remove tools.

3. TURBINE SHAFT FRONT AND REAR STIFFENER AND BALANCE WEIGHT - REMOVAL.

(See figure 1.)

- a. Remove bolts(2) securing stiffeners(3 and 4, figure 1) as follows:
 - (1) Remove bolts(2) and balance weight assemblies(8) from front of shaft(5) using PWA 52790 extension and detail-3 sockets.
 - (2) Remove balance weight assemblies by disassembling clips and bolts. Discard retaining clips.



G1490 (24X2)

- | | |
|---|--------------------------------------|
| 1. Turbine shaft lock seat | 9. PWA 52790 wrench assembly |
| 2. Bolt | 10. Collet surface A |
| 3. Front stiffener | 11. Collet surface B |
| 4. Rear stiffener assembly | 12. SAALC X8750309 stiffener remover |
| 5. Front compressor drive turbine shaft | 13. Mandrel nut |
| 6. No. 5 bearing heat shield | 14. PWA 50950 detail-4 ring |
| 7. No. 5 bearing plug | 15. PWA 50950 puller detail-18 plate |
| 8. Counter weight assembly | 16. Bolt |

Figure 1. Front Compressor Drive Turbine Shaft - Disassembly

NOTE

Stiffener(3 and 4) can be removed using PWA 50950 puller and SAALC X8750309 per steps b. and c., or using PWA 56505 puller per steps b1. and c1.

b. Remove front stiffener(3) using PWA 50950 puller as follows:

- (1) Install PWA 50950 puller detail-4 ring(14) onto rear of shaft(5).
- (2) Adjust end of SAALC X8750309 stiffener remover(12) to obtain minimum diameter.
- (3) Swing puller detail-18 plate(15) to open position and install SAALC X8750309 stiffener remover(12) inside of shaft. Align mandrel surface A(10) of remover with ID of front stiffener(3).
- (4) Adjust mandrel nut(13) to align with puller detail-18 plate(15). Swing plate to closed position and secure with bolts(16).
- (5) Separate front stiffener(3) from shaft(5) by turning mandrel nut(13) in a counterclockwise direction.
- (6) Loosen bolts(16) securing puller plate(15). Swing plate to open position and remove remover.

b1. Remove front stiffener(3) using PWA 56505 puller as follows:

- (1) Install PWA 56505 detail-15 ring onto rear of shaft.
- (2) Adjust end of PWA 56505 stiffener puller to obtain minimum diameter of collet detail-10.
- (3) Swing puller detail-5 plate to open position install PWA 56505 stiffener puller inside of shaft. Align expander detail-11 of puller with ID of front stiffener resting puller support detail-13 on ID of shaft.
- (4) Adjust mandrel nut detail-7 to align with puller detail-5 plate. Swing plate to closed position and secure with bolts.
- (5) Separate front stiffener from shaft by turning mandrel nut in a counterclockwise direction. Continue rotation until stop is reached. This will insure puller collet surface is forward of front side of rear stiffener assembly.

- c. Remove rear stiffener assembly(4) using PWA 50950 puller as follows:
- (1) Adjust end of SAALC X8750309 stiffener remover(12) to obtain minimum diameter.
 - (2) Swing puller detail-18 plate(15) to open position. Install SAALC X8750309 stiffener remover(12) inside shaft. Aligning collet surface B (11) of remover with ID of rear stiffener assembly(4).
 - (3) Install PWA 52790 wrench assembly(9) into front end of shaft(5) and into end of SAALC X8750309 stiffener remover(12).
 - (4) Ensure puller collet surface B(11) of stiffener remover(12) is forward of front side of rear stiffener assembly(4).
 - (5) Tighten PWA 52790 wrench assembly(9) to expand puller collet of stiffener remover into ID of rear stiffener assembly.
 - (6) Adjust mandrel nut(13) to align with puller plate(15). Swing puller plate(15) to closed position and secure with bolts(16).
 - (7) Separate rear stiffener assembly(4) from shaft(5) by turning mandrel nut(13) in a clockwise direction. Loosen collet, remove wrench assembly(9).
 - (8) Loosen bolts(16) securing puller plate(15). Swing plate to open position and remove remover.
 - (9) Install suitable protector onto end of PWA 52790 wrench assembly(9). Install wrench assembly into front of shaft(5).
 - (10) Carefully push rear stiffener assembly(4) rearward approximately six inches.
 - (11) Remove wrench assembly(9) and install into rear of shaft(5).
 - (12) Carefully push front stiffener(3) forward approximately six inches.
 - (13) Align stiffeners to obtain clearance and remove using mechanical fingers or other appropriate tool.

c1. Remove rear stiffener assembly(4) using PWA 56505 puller as follows:

- (1) Adjust end of PWA 56505 stiffener puller detail-1 by holding handle detail-3, turn clockwise to expand puller collet into rear of ID of rear stiffener assembly.
- (2) Separate rear stiffener assembly from shaft by turning mandrel nut in a clockwise direction. Loosen collet.
- (3) Loosen bolts securing puller plate. Swing plate to open position and remove puller.
- (4) Install suitable protector onto end of PWA 52790 wrench assembly. Install wrench assembly into front of shaft. Align stiffeners to obtain clearance and remove stiffeners using wrench assembly, mechanical fingers, or other appropriate tool.

4. NO. 5 BEARING HEAT SHIELD - REMOVAL.

(See figure 1.)

- a. Remove heat shield(6, figure 1) from OD of front compressor drive turbine shaft as follows:
 - (1) Install PWA 52616 puller so that the three jaws engage front flange of heat shield and puck rests in front compressor drive turbine shaft.
 - (2) Position retaining ring over jaws.
 - (3) Attach PWA 55380 pump and apply hydraulic pressure to remove heat shield.
- b. If heat shield(6) does not unseat, remove tool and proceed as follows:
 - (1) Install No. 5 bearing plug.
 - (2) Load shaft ID with dry-ice at No. 5 bearing end and reposition tool.
 - (3) When frost or condensation appears, apply hydraulic pressure and remove heat shield.

WORK PACKAGE

INTRODUCTION

FAN DRIVE TURBINE MODULE -

CLEANING

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 2

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2					0

T.O. 2J-F100-53-9

WP 200 00

1. INTRODUCTION.

This work package introduces the 200 00 through 299 00 series of work packages for fan drive turbine module cleaning. The following work packages are included in this series:

WP/SWP No.	Title
201 00	Fan Drive Turbine Module Parts - Cleaning
202 00 through 299 00	Open

WORK PACKAGE**TECHNICAL PROCEDURES****FAN DRIVE TURBINE MODULE PARTS -****CLEANING****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 24

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	30	7 - 12	0	15	14
2	14	12A Added	14	16 - 18	0
3 - 4	0	12B Blank Added	14	19	15
5	21	13	14	20 - 21	0
6	30	14	0	22	15

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Cleaning, Vapor Degreasing (SPOP 3) - - - - -	SWP 031 01
Cleaning, Alkaline Rust Remover, Long Soak (SPOP 203) - - -	SWP 031 09
Cleaning, Wet Abrasive Blast (SPOP 9) - - - - -	SWP 031 19

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Oil, corrosion preventive	MIL-C-8188
Perchlorethylene	O-T-236

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains a table of all fan drive turbine module parts requiring cleaning. The table lists parts by name and part number, identifies parent material, illustrates part, lists any special cleaning instructions, and references the WP/SWP where cleaning procedures are described.
- b. Recommended cleaning work package options for each part are listed in order of increasing severity. The primary purpose of cleaning is to prepare part for inspection. Select the least severe process for this purpose, based on operator's experience. Proceed to a more severe process only if required for effective results.

2. FAN DRIVE TURBINE MODULE - PARTS CLEANING.

(See Table 1.)

Table 1. Fan Drive Turbine Module - Parts Cleaning

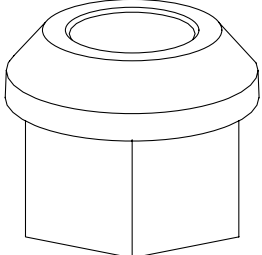
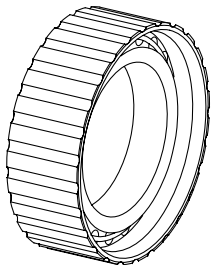
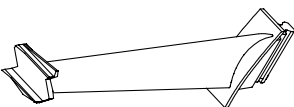
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Ball end - rod, No. 5 bearing support	 <p>PN 4024675 -C PN 4024675 AMS 5663 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Bearing - roller, cylindrical, No. 5	 <p>PN 4067892 -C PN 4067892, 4067893 4067894, 4067895 PWA 725 Steel</p>	Refer to paragraph 4.	
Blade - turbine rotor, 3rd stage	 <p>PN 4075603 -C PN 4075603 PWA 1484 Nickel Alloy</p>		SWP 031 01 SWP 031 09 SWP 031 19

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

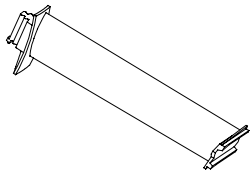
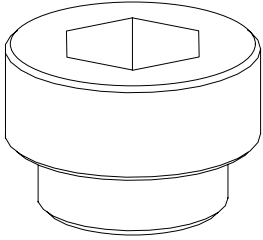
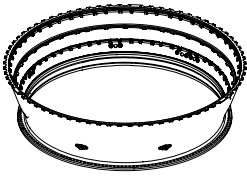
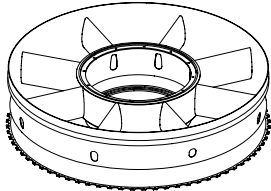
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Blade - turbine rotor, 4th stage	 <p>PN 4075404 -C PN 4075404 PWA 658 Nickel Alloy</p>		SWP 031 01 SWP 031 09 SWP 031 19
Cap - oil check valve	 <p>PN 4071207 -C PN 4071207 AMS 5744 Stainless Steel</p>		SWP 031 01
Case assembly - turbine, rear	 <p>PN 4079211 -C PN 4079211 PWA 1007 Nickel Alloy</p>		SWP 031 01 SWP 031 09 SWP 031 19
Case assembly - turbine exhaust	 <p>PN 4071463 -C PN 4071463 AMS 5544 PWA 649</p>		SWP 031 01 SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

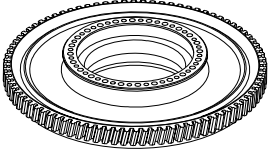
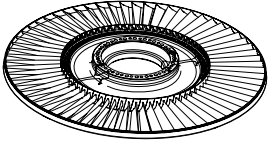
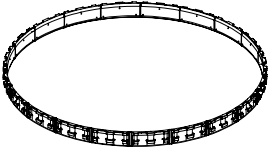
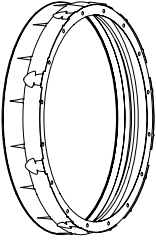
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Disk - turbine, 3rd stage	 <p>PN 4084228 -C</p> <p>PN 4084103 PN 4084228 PN 4084231 PWA 1106 Nickel Alloy</p>		SWP 031 01 SWP 031 09 SWP 031 19
Disk - turbine, 4th stage	 <p>PN 4072484 -C</p> <p>PN 4072484 PWA 1106 Nickel Alloy</p>		SWP 031 01 SWP 031 09 SWP 031 19
Duct segment - turbine, 2nd stage	 <p>PN 4077682 -C</p> <p>PN 4077682 PWA 1426 Nickel Alloy</p>		SWP 031 01 SWP 031 09 SWP 031 19
Duct - turbine exhaust (front)hub assembly	 <p>PN 4072533 -C</p> <p>PN 4072533 AMS 5599 Nickel Alloy</p>		SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

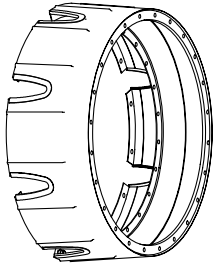
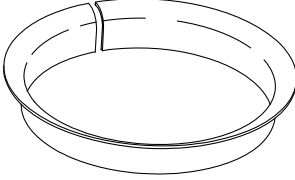
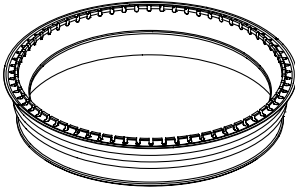
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Duct - turbine exhaust (rear)	 <p>PN 4072535 -C</p> <p>PN 4072533</p> <p>AMS 5599</p> <p>Nickel Alloy guid</p>		SWP 031 09
Guide - No. 5 bearing roller	 <p>PN 4075318 -C</p> <p>PN 4075318</p> <p>AMS 5525</p> <p>Stainless Steel</p>		SWP 031 01
Hub assembly, turbine, rear	 <p>PN 4064229 -C</p> <p>PN 4064229</p> <p>PWA 1016</p> <p>Nickel Alloy</p>		SWP 031 01 SWP 031 19 SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

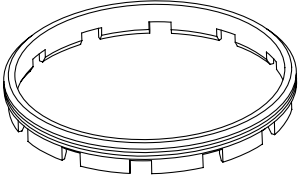
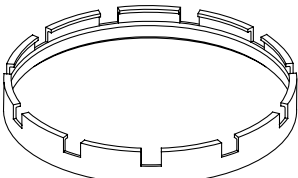
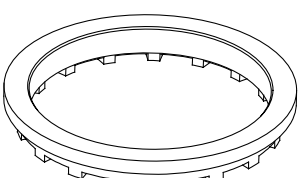
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Nut - bearing retaining, externally threaded	 <p>PN 4001681 -C PN 4001681 AMS 6322 AMS 6323 Low Alloy Steel</p>		SWP 031 01
Nut - bearing retaining, internally threaded	 <p>PN 4022304 -C PN 4022304 AMS 6322 AMS 6323 Low Alloy Steel</p>		SWP 031 01
Nut - bearing retaining, internally threaded	 <p>PN 4060478 -C PN 4060478 AMS 6322 AMS 6323 Low Alloy Steel</p>		SWP 031 01

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

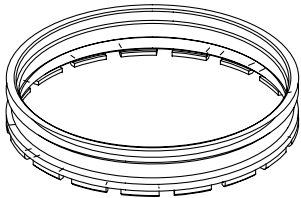
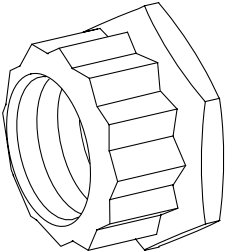
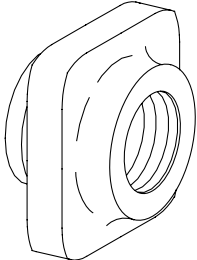
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Nut - compressor drive shaft	 <p>PN 4026463 -C PN 4026463 PWA 1016 Nickel Alloy</p>		SWP 031 01
Nut - tierod	 <p>PN 4069047 -C PN 4069047 AMS 5709 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Nut - tierod	 <p>PN 4069048 -C PN 4069048 AMS 5709 Nickel Alloy</p>		SWP 031 01 SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

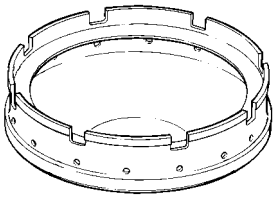
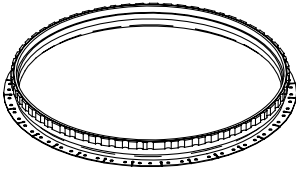
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Plug - No. 5 bearing	 <p>PN 4010079 -C</p> <p>PN 4010079 AMS 4928 Titanium Alloy</p>		SWP 031 01 SWP 031 09
Ring - assembly of, air sealing, turbine, 3rd stage	 <p>PN 4071395 -C</p> <p>PN 4071395 AMS 5540 Nickel Alloy</p>		SWP 031 01 SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

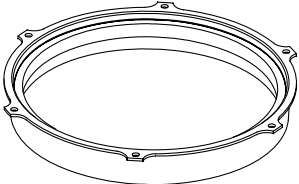
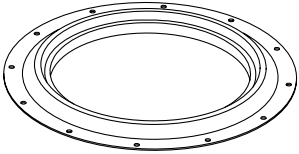
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Ring - assembly of, air sealing, turbine, 3rd stage	 <p>PN 4064232 -C</p> <p>PN 4064232 AMS 5708 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Ring - assembly of, air sealing, turbine, 4th stage	 <p>PN 4073591 -C</p> <p>PN 4073591 AMS 5599 Nickel Alloy</p>		SWP 031 01 SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

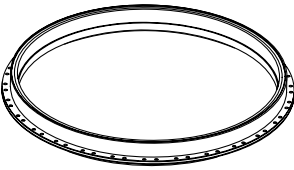
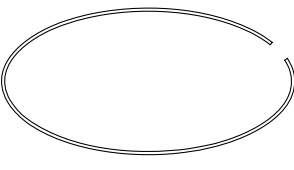
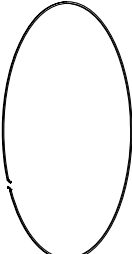
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Ring - air sealing, turbine, 4th stage	 <p>PN 4068968 -C PN 4068968 Stainless Steel</p>		SWP 031 01 SWP 031 09
Ring, retaining	 <p>PN 4026826 -C PN 4026826 AMS 5699 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Ring - Retaining, 4th stage	 <p>PN 4073491 -C PN 4073491 AMS 5544 Nickel Alloy</p>		SWP 031 01 SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

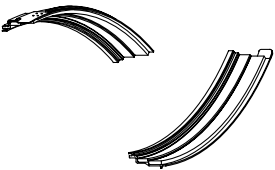
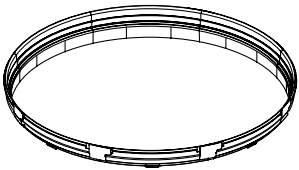
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Ring segment - assembly of, air sealing, turbine, 3rd stage	 <p>PN 4069977 -C</p> <p>PN 4069977 PWA 658 Nickel Alloy</p>		<p>SWP 031 01</p> <p>SWP 031 09</p> <p>SWP 031 19</p>
Ring segment - assembly of, air sealing, turbine, 3rd stage	 <p>PN 4069978 -C</p> <p>PN 4069978 PWA 658 Nickel Alloy</p>		<p>SWP 031 01</p> <p>SWP 031 09</p> <p>SWP 031 19</p>

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

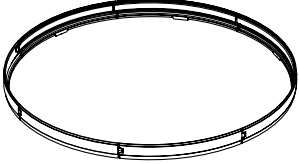
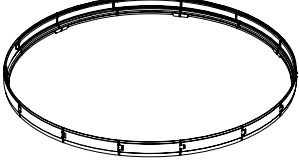
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Ring segment - assembly of, air sealing, turbine, 4th stage (seven segment configuration)	 <p>PN 4069437 -C</p> <p>PN 4079812 AMS 5706 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Ring segment - assembly of, air sealing, turbine, 4th stage (14 segment configuration)	 <p>PN 4083666 -C</p> <p>PN 4083666 PWA 658 Nickel Alloy</p>		SWP 031 01 SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

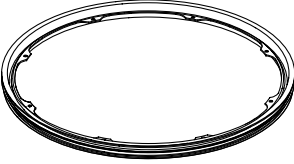
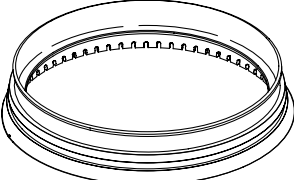
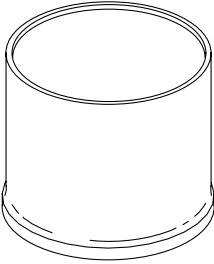
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Seal - air turbine, 3rd stage	 <p>PN 4071396 -C PN 4071396 PWA 1016 Nickel Alloy</p>		SWP 031 01 SWP 031 09 SWP 031 19
Seal - air turbine, 4th stage	 <p>PN 4073146 -C PN 4073146 PWA 1016 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Shield - heat front compressor drive shaft	 <p>PN 4026467 -C PN 4026467 AMS 5582 AMS 5671 Nickel Alloy</p>		SWP 031 01

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

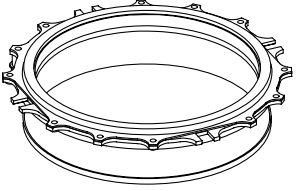
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Seal - assembly of, face, No. 5 bearing	 <p>PN 4018382 -C PN 4018382 PWA 36085-11 or -21 Carbon Graphite</p>	See paragraph 3.	

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

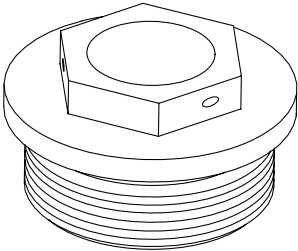
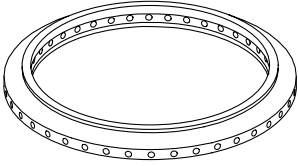
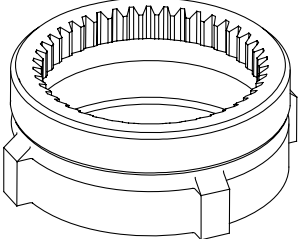
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Seat - ball socket, No. 5 bearing support	 <p>PN 4034066 -C</p> <p>PN 4034066 AMS 5663 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Seat - No. 5 bearing seal	 <p>PN 4021784 -C</p> <p>PN 4021784 AMS 6322 AMS 6323 Low Alloy Steel</p>		SWP 031 09
Seat - turbine shaft lock	 <p>PN 4010246 -C</p> <p>PN 4010246 AMS 6304 Low Alloy Steel</p>		SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

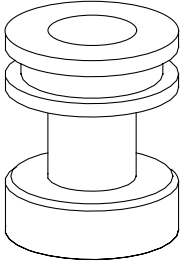
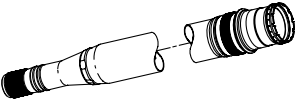
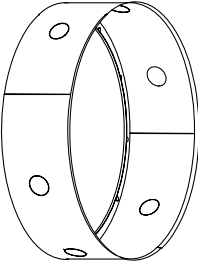
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Seat - valve oil check	 <p>PN 4071208 -C</p> <p>PN 4071208 AMS 5744 Stainless Steel</p>		SWP 031 01 SWP 031 09
Shaft assembly - front compressor drive, turbine	 <p>PN 4060568 -C</p> <p>PN 4060568 PWA 817 Steel</p>		SWP 031 01 SWP 031 09
Shield - heat, No. 5 bearing	 <p>PN 4076292 -C</p> <p>PN 4076292 AMS 5599 Nickel Alloy</p>		SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)


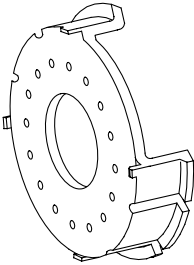
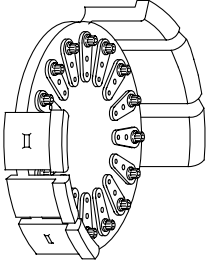
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Spacer - No. 5 bearing heat shield	 <p>PN 4077211 -C</p> <p>PN 4077211 AMS 5599 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Stiffener, turbine shaft	 <p>PN 4060565 -C</p> <p>PN 4060565 AMS 5732 Corrosion and Heat Resistant Steel</p>		SWP 031 01 SWP 031 09
Stiffener, turbine shaft	 <p>PN 4060566 -C</p> <p>PN 4060566 AMS 5732 Corrosion and Heat Resistant Steel</p>		SWP 031 01 SWP 031 09

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

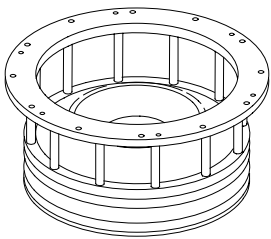
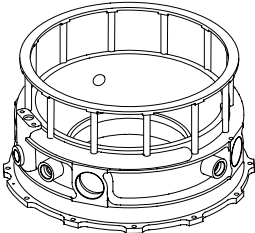
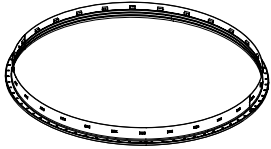
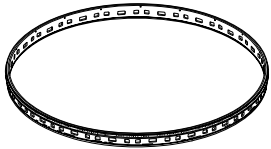
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Support assembly - No. 5 bearing inner	 <p>PN 4076393 -C PN 4076393 PWA 1265-2 Titanium Alloy</p>		SWP 031 01 SWP 031 09
Support - No. 5 bearing seal	 <p>PN 4071212 -C PN 4071212 PWA 649-3 Nickel Alloy</p>	Refer to paragraph 5.	
Support - turbine air sealing ring, 4th stage	 <p>PN 4071473 -C PN 4071473 AMS 5707 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Support - turbine duct, 2nd stage	 <p>PN 4080526 -C PN 4080526 PWA 1198 Nickel Alloy</p>		SWP 031 01 SWP 031 09 SWP 031 19

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

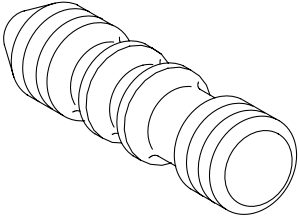
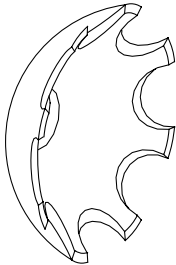
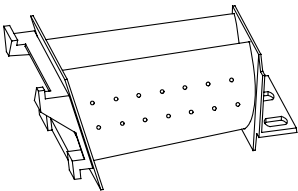
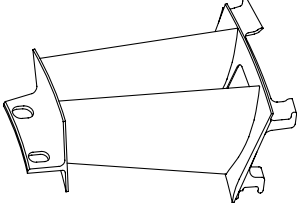
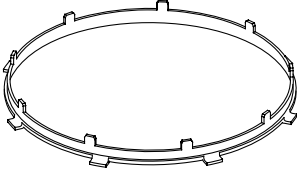
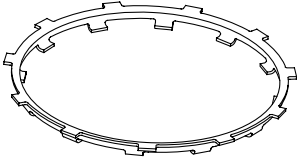
Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Tierod - turbine	 <p>PN 4069049 -C</p> <p>PN 4069049 PWA 92 Nickel Alloy</p>		SWP 031 01 SWP 031 09
Valve - oil check	 <p>PN 4067089 -C</p> <p>PN 4067089 AMS 5744 Stainless Steel</p>		SWP 031 01
Vane - turbine stator, 3rd stage	 <p>PN 4075173 -C</p> <p>PN 4075173 4075193 4075253 Assembly</p>	To Be Inc.	

Table 1. Fan Drive Turbine Module - Parts Cleaning (continued)

Part Name	Illustration Typical Part Number and Parent Material	Special Cleaning Instructions	Cleaning WP/SWP Reference T.O. 2J-F100-53-1
Vane - turbine stator, 4th stage	 <p>PN 4075254 -C</p> <p>PN 4075254 PWA 658 Nickel Alloy</p>		SWP 031 01 SWP 031 09 SWP 031 19
Washer - key	 <p>PN 4026464 -C</p> <p>PN 4026464 AMS 5599 Nickel Alloy</p>		SWP 031 09
Washer - key	 <p>PN 4074203 -C</p> <p>PN 4074203 AMS 5510 Corrosion and Heat Resistant Steel</p>		SWP 031 01 SWP 031 09

3. FACE-TYPE OIL SEALS.



Never wipe seal with a cloth.
Do not wash seal with kerosene
or any type carbon solvent.
These materials can remove the
carbon seal impregnant,
resulting in increased surface
porosity and higher wear rates.

- a. Clean seal only in clean, warm
120° to 140°F (49° to 60°C)
lubricating oil for a minimum of
30 minutes.
- b. If necessary, remove coke
deposits using a dull-edged
non-metallic tool only.

4. ANTIFRICTION BEARINGS.

- a. Clean bearings per SPOP 14 or
SPOP 214. Refer to T.O.
2-1-111.
- b. Bearings shall be processed as
follows:
 - (1) Mainshaft bearings shall
remain assembled during
cleaning.



Mechanical cleaning may cause
bearing damage.

- (2) No mechanical cleaning
allowed. This includes
tumbling, grinding, wire
brushing, sanding, polishing
or any other process which
will alter the original
surface of bearing.
- (3) Dip mainshaft bearing in
MIL-C-8188 corrosion
preventive oil.

5. No. 5 BEARING SEAL SUPPORT

- a. Ensure oil check valve
assemblies have been removed per
WP 025 00.



Do not immerse part in cleaning
solution if heatshield is
installed. Cleaning solution
could become trapped behind
heatshield and cause stress
corrosion.

- b. Clean seal ring groove with
clean cloth or nylon bristle
brush saturated with
perchloroethylene O-T-236 or
equivalent to remove all
deposits.
- c. Wipe remaining part with cloth
moistened with perchloroethylene
O-T-236 or equivalent.
- d. If heatshield is removed, clean
support. Refer to T.O.
2J-F100-53-1, SWP 031 01 or
SWP 031 09.

WORK PACKAGE

INTRODUCTION

FAN DRIVE TURBINE MODULE -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	3	14	4	28
2	16				

1. INTRODUCTION.

This work package introduces the 300 00 through 399 00 series of work packages for fan drive turbine module inspection. The following work packages are included in this series:

WP/SWP No.	Title
301 00	Nut, Compressor Driveshaft, Front - Inspection
302 00	Shaft Assembly - Front Compressor Drive, Turbine - Inspection
303 00	Ring Segment, Assembly, Air Sealing, Turbine, Third Stage - Inspection
304 00	Case Assembly - Turbine, Rear and Support and Duct Set - Turbine, Rear - Inspection
305 00	Ring Assembly - Air Sealing, Turbine, Third Stage - Inspection
306 00	Vane - Turbine Stator, Third Stage - Inspection
307 00	Vane - Turbine Stator, Fourth Stage - Inspection
308 00	Ring Assembly - Air Sealing, Turbine, Third Stage (Inner) - Inspection
309 00	Ring Assembly - Air Sealing, Turbine, Fourth Stage - Inspection
310 00	Air Seal, Turbine, Third Stage - Inspection
311 00	Ring - Retaining, Fourth Stage Turbine Stator - Inspection
312 00	Disk - Turbine, Third Stage - Inspection
313 00	Blade, Turbine Rotor, Third Stage - Inspection
314 00	Blade, Turbine Rotor, Fourth Stage - Inspection
315 00	Fan Drive Turbine Module - Service Cycle Marking
316 00	Tierod, Turbine - Inspection
317 00	Hub Assembly, Turbine Rear - Inspection
318 00	Ring - Assembly of - Air Sealing, Turbine, Fourth Stage - Inspection

WP/SWP No.	Title
319 00	Support - Turbine Air Sealing Ring, Fourth Stage - Inspection
320 00	Air Seal - Turbine, Fourth Stage - Inspection
321 00	Ring Segment - Assembly of, Air Sealing, Turbine, Fourth Stage - Inspection
322 00	Disk Assembly - Turbine, Fourth Stage - Inspection
323 00	Guide - No. 5 Bearing Roller - Inspection
324 00	Case - Assembly of, Turbine Exhaust - Inspection
325 00	Seal - Assembly of, No. 5 Bearing - Inspection
326 00	Nut, Bearing Retaining (Externally Threaded) - Inspection
327 00	Seat - Ball Socket, No. 5 Bearing Support - Inspection
328 00	Ball - End - Rod, No. 5 Bearing Support - Inspection
329 00	Deleted
330 00	Seal Assembly, Face, No. 5 Bearing - Inspection
331 00	Nut - Retaining, Plain, Round (No.5 Bearing) - Inspection
332 00	Bearing - Roller, Cylindrical, No. 5 - Inspection
333 00	Seat - No. 5 Bearing Seal - Inspection
334 00	Nut - Retaining, Plain, Round (No. 5 Bearing Seal Seat) - Inspection
335 00	Support Assembly - No. 5 Bearing, Inner - Inspection
336 00	Cap - Oil Check Valve - Inspection
337 00	Seat - Valve, Oil Check - Inspection
338 00	Stop - Oil Check Valve - Inspection
339 00	Valve - Oil Check - Inspection
340 00	Seat - Turbine Shaft Lock - Inspection

WP/SWP No.	Title
341 00	Front Duct Assembly, Turbine Exhaust - Inspection
342 00	Rear Duct Assembly, Turbine Exhaust - Inspection
343 00	Stiffeners, Turbine Shaft - Inspection
344 00	Shield, Heat, Front Compressor Driveshaft - Inspection
345 00	Plug, No. 5 Bearing - Inspection
346 00	Ring Retaining Segment 3rd Stage - Inspection
347 00	Deleted
348 00	No. 5 Bearing Heat Shield Spacer - Inspection
349 00	Open
through	
399 00	

WORK PACKAGE

TECHNICAL PROCEDURES

NUT, COMPRESSOR DRIVESHAFT, FRONT -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	3	18	4 Blank	0
2	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

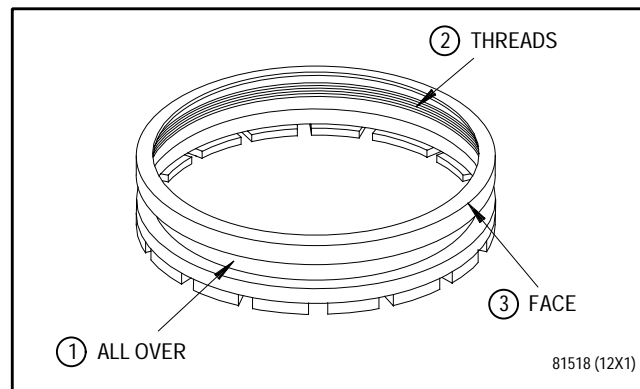
1. INTRODUCTION.

- a. This work package contains instructions for inspection of front compressor driveshaft nut.

2. FRONT COMPRESSOR DRIVESHAFT NUT - INSPECTION.

(See Figure 1.)

- a. Visually inspect front compressor driveshaft nut.
(See figure 1.)
- b. Fluorescent penetrant inspect front compressor driveshaft nut. Refer to T.O. 2J-F100-9. No cracks allowed.



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. All over - Cracks	Not serviceable	Not reparable	Replace nut.
2. Threads - Damaged	Not serviceable	See corrective action.	Remove all pickup and high metal with fine stone. Blend. Refer to T.O. 2-1-111.
Worn antigalling compound	Not serviceable	See corrective action.	Apply antigalling compound per WP 401 00.
3. Face - Damaged	Not serviceable	Not reparable	Replace nut.
Worn antigalling compound	Not serviceable	See corrective action.	Apply antigalling compound per WP 401 00.

Figure 1. Front Compressor Driveshaft Nut - Inspection

WORK PACKAGE**TECHNICAL PROCEDURES****SHAFT - FRONT COMPRESSOR DRIVE, TURBINE -****INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 18

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	28	8A Added	7	10 - 11	7
4	7	8B Blank Added	7	12	0
5 - 7	0	9	0	13 - 14	7
8	7			15 - 16 Added	28

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Driveshaft Assembly, Front Compressor, Turbine -	
Inspection - - - - -	WP 601 00
Engine - - - - -	T.O. 2J-F100-53-5
Engine Table of Limits and Clearance Charts - - - - -	WP 801 00
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Shaft Assembly - Front Compressor Drive, Turbine -	
Repair - - - - -	WP 402 00
Fan Drive Turbine Module Table of Limits and Clearance	
Charts - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for the inspection of the front compressor drive turbine shaft assembly.

2. FRONT COMPRESSOR DRIVE TURBINE SHAFT - INSPECTION.

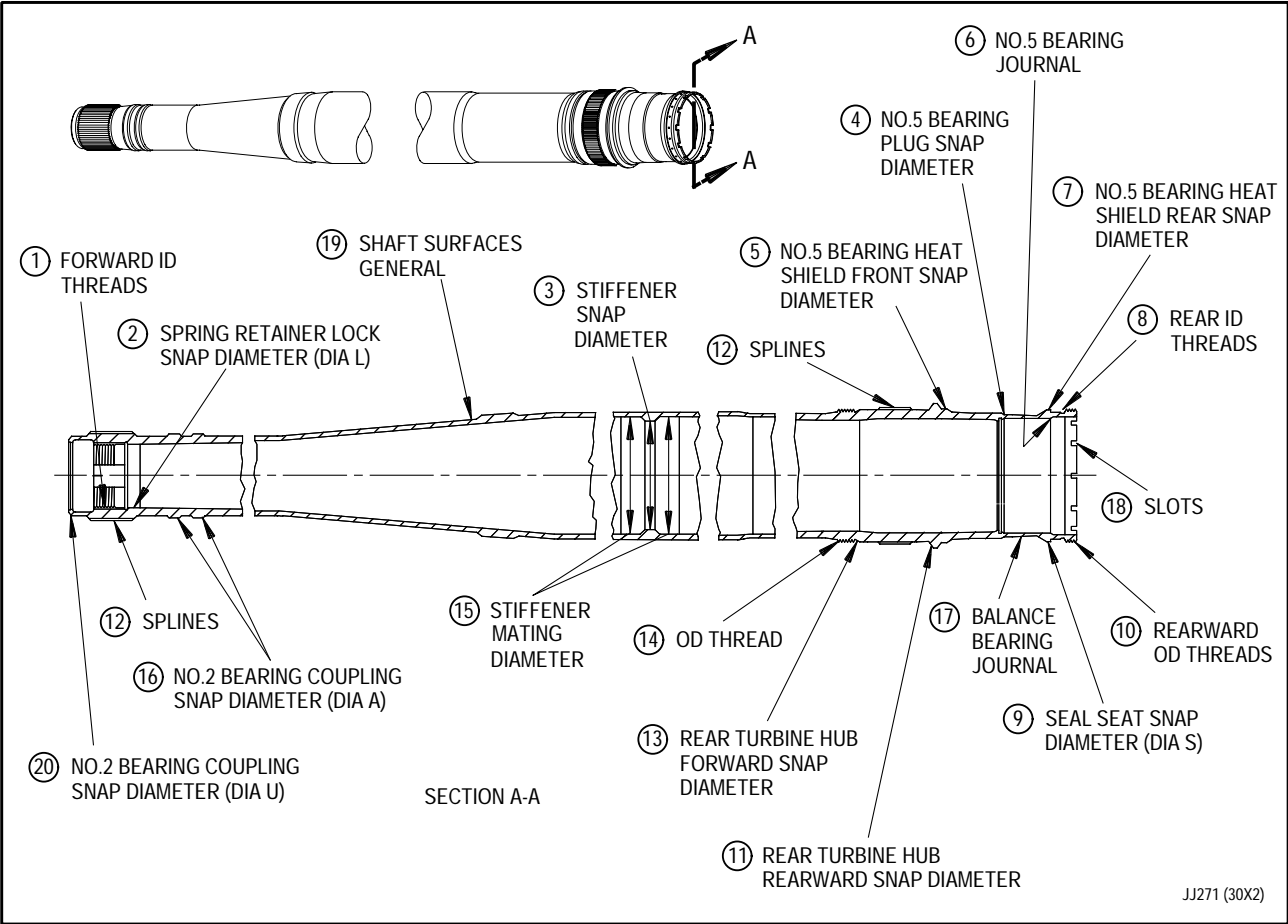
(See Figure 1.)



To prevent damage after reported or suspected engine over-temperature, shaft material shall be hardness tested.

- a. Ensure that front compressor drive turbine shaft has been cleaned per WP 201 00.
- b. Test shaft material hardness in three places around circumference near forward and aft ends.
 - (1) Blend raised material.
 - (2) Hardness shall be Rockwell C35 to 40 or equivalent.
 - (3) Record hardness test results.

- c. Perform dimensional runout check per paragraph 3 if shaft was removed from engine with fan blade, 3rd or 4th stage turbine blade, or No. 1, 2, or 5 bearing failure.
- d. Fluorescent penetrant inspect front compressor drive turbine shaft. Refer to T.O. 2J-F100-9, WP 601 00. No cracks allowed.
- e. Visually inspect front compressor drive turbine shaft. (See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Forward ID threads -			
NOTE			
Thread damage greater than maximum repairable limits is cause for part condemnation.			
Thread damage	Not serviceable	One thread for full circumference, or multiple partial threads for a total combined thread length of 7 3/8 inches to full thread depth.	Remove raised metal and pickup with fine stone. Blend per WP 402 00.

Figure 1. Front Compressor Drive Turbine Shaft - Inspection (Sheet 1 of 2)

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
2. Spring retainer lock snap diameter (Diameter L) -			
NOTE			
Snaps out-of-round beyond maximum repairable limits are cause for part condemnation.			
Wear	Refer to WP 801 00, Reference 4153.	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.010 inch deep	Refer to WP 402 00.
Corrosion	None permitted	See corrective action.	Remove corrosion. Refer to T.O. 2J-F100-53-1, SWP 031 13.
3. Stiffener snap diameter -			
Wear	Refer to WP 801 00, Reference 4158.	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.010 inch deep	Refer to WP 402 00.
Corrosion	None permitted	See corrective action.	Remove corrosion. Refer to T.O. 2J-F100-53-1, SWP 031 13.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
4. No. 5 bearing plug snap diameter -			
NOTE			
Snaps out-of-round beyond maximum repairable limits are cause for part condemnation.			
Wear	Refer to WP 801 00, Reference 4127.	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.010 inch deep	Refer to WP 402 00.
Corrosion	None permitted	See corrective action.	Remove corrosion. Refer to T.O.2J-F100-53-1, SWP 031 13.
5. No. 5 bearing heat shield front snap diameter -			

NOTE

Snaps out-of-round beyond maximum repairable limits are cause for part condemnation.

Wear	Refer to WP 801 00, Reference 4123.	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.010 inch deep	Refer to WP 402 00.
Corrosion	None permitted	See corrective action	Remove corrosion. Refer to T.O.2J-F100-53-1, SWP 031 13.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
6. No. 5 bearing journal -			
Wear	Refer to WP 801 00, Reference 4129.	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.005 inch deep	Refer to WP 402 00.
7. No. 5 bearing heat shield rear snap diameter -			

NOTE

Snaps out-of-round beyond maximum repairable limits are cause for part condemnation.

Wear	Refer to WP 801 00, Reference 4140.	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.010 inch deep	Refer to WP 402 00.
Corrosion	None permitted	See corrective action.	Remove corrosion. Refer to T.O.2J-F100-53-1, SWP 031 13.

8. Rear ID threads -

NOTE

Thread damage greater than maximum repairable limits is cause for part condemnation.

Thread damage	Not serviceable	One thread for full circumference, or multiple partial threads for a total combined thread length of 15.5 inches to full thread depth.	Remove raised metal and pickup with fine stone. Blend per WP 402 00.
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Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
9. Seal seat snap diameter (Diameter S) -			
NOTE			
Snaps out-of-round beyond maximum repairable limits are cause for part condemnation.			
Wear	5.380 to 5.381 inch diameter	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.010 inch deep	Refer to WP 402 00.
Corrosion	None permitted	See corrective action.	Remove corrosion. Refer to T.O.2J-F100-53-1, SWP 031 13.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
10.Rearward OD threads -			
NOTE			
Thread damage greater than maximum repairable limits is cause for part condemnation.			
Thread damage or missing threads	Not serviceable	One thread for full circumference, or multiple threads for a total thread length of 16.750 inches to full thread depth.	Remove raised metal and pickup with fine stone. Blend per WP 402 00.
Corrosion	Not serviceable	See corrective action.	Remove corrosion. Refer to T.O. 2J-F100-53-1, SWP 031 13. Inspect threads and slots for complete removal of all foreign matter. Do not vapor degrease.
Pitting	Permitted on all except the last three threads (see sheet 2). Ensure that nut retention is not compromised by pitting. Inserted key washer (PN 4074203) must not rotate more than 10 degrees.	One thread for full circumference, or multiple threads for a total thread length of 16.750 inches to full thread depth.	Remove raised metal and pickup by chasing threads or by blending per WP 402 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
11.Rear turbine hub rearward snap diameter -			
NOTE			
Snaps out-of-round beyond maximum reparable limits are cause for part condemnation.			
Wear	Refer to WP 801 00, Reference 4193.	See corrective action.	Refer to WP 402 00.
Corrosion	None permitted	See corrective action.	Remove corrosion. Refer to T.O.2J-F100-53-1, SWP 031 13.
12.Splines -			
Pits, nicks and dents	Not serviceable	All pickup and raised metal shall be removed.	Remove raised metal and pickup with fine stone. Blend per WP 402 00.
13.Rear turbine hub forward snap diameter -			

NOTE

Snaps out-of-round beyond maximum reparable limits are cause for part condemnation.

Wear	Refer to WP 801 00, Reference 4194.	See corrective action.	Refer to WP 402 00.
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Legend for figure 1 (continued)

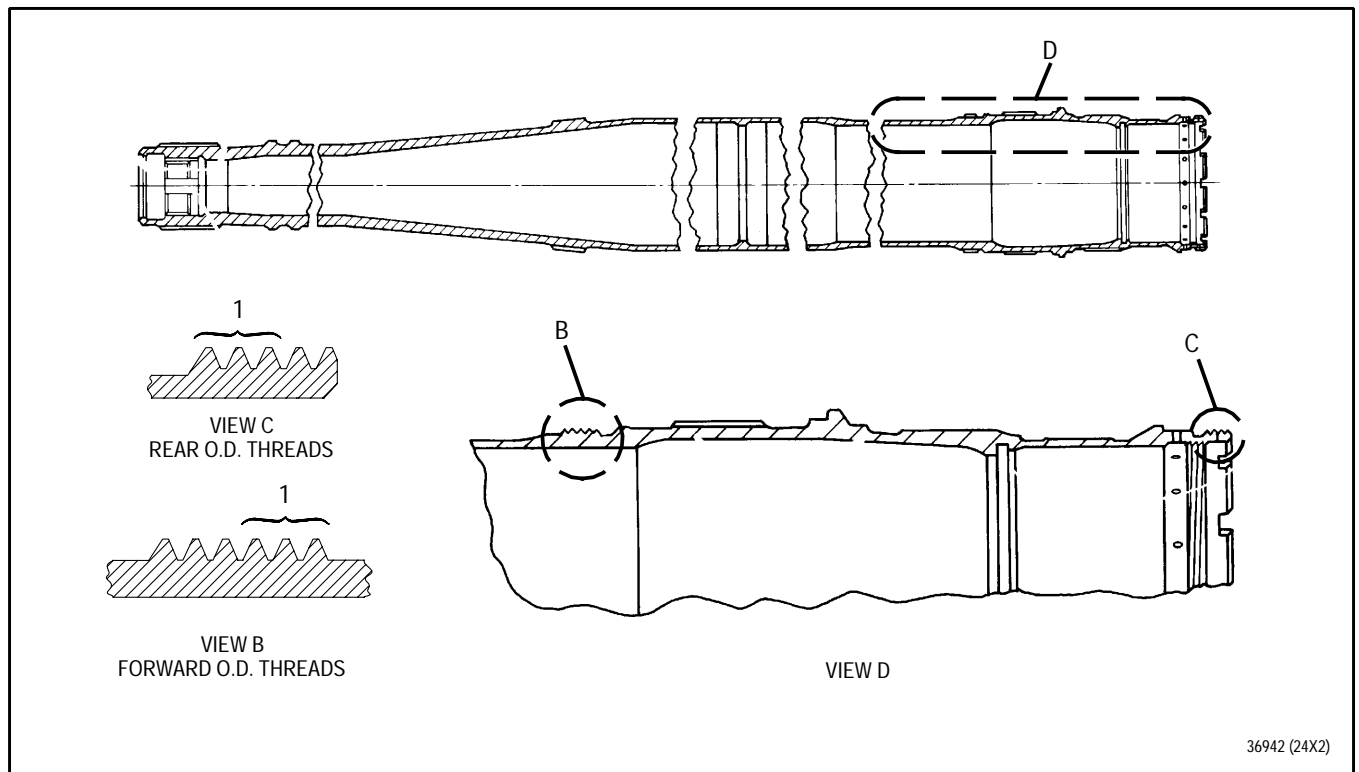
Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
13.Rear turbine hub forward snap diameter - (continued)			
Corrosion	None permitted	See corrective action.	Remove corrosion. Refer to T.O.2J-F100-53-1, SWP 031 13.
NOTE			
Thread damage greater than maximum repairable limits is cause for part condemnation.			
14.OD Threads -			
Thread damage or missing threads	Not serviceable	One thread for full circumference, or multiple threads for a total thread length of 17.375 inches to full thread depth.	Remove raised metal and pickup with fine stone. Blend per WP 402 00.
Corrosion	Not serviceable	See corrective action	Remove corrosion. Refer to T.O. 2J-F100-53-1 SWP 031 13. Inspect threads and slots for complete removal of all foreign matter. Do not vapor degrease. Repaint per WP 402 00.
Pitting	Permitted on all except the last three threads (see sheet 2). Ensure that nut retention is not compromised by pitting. Inserted key washer (PN 4026464) must not rotate more than 10 degrees.	One thread for full circumference, or multiple threads for a total thread length of 17.375 inches to full thread depth.	Remove raised metal and pickup by chasing threads or by blending per WP 402 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
15.Stiffener mating diameter -			
Wear	Refer to WP 801 00, Reference 4157.	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.010 inch deep	Refer to WP 402 00.
Corrosion	None permitted	See corrective action.	Remove corrosion. Refer to T.O.2J-F100-53-1, SWP 031 13.
16.No. 2 bearing coupling snap diameter (Diameter A) -			
NOTE			
Snaps out-of-round beyond maximum repairable limits are cause for part condemnation.			
Wear	Refer to WP 801 00 References 32 and 33.	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.010 inch deep	Refer to WP 402 00.
Corrosion	None permitted	See corrective action.	Remove corrosion. Refer to T.O.2J-F100-53-1, SWP 031 13.
17.Balance bearing journal -			
Wear	5.144 inch minimum diameter	See corrective action.	Refer to WP 402 00.
Pits	0.005 inch deep	0.005 inch deep	Refer to WP 402 00.
18.Slots -			
Nicks and dents	0.020 inch deep	0.100 inch each side of slot. Maximum slot dimension 0.577 inch.	Refer to WP 402 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
19. Shaft surfaces (OD and ID) general -			
Cracks	Not serviceable	Not repairable	Replace shaft assembly.
Circumferential, galling, scoring	0.015 inch deep	Repair is permissible only for 40% of shaft circumference. Remaining 60% shall be unmarked.	Sharp ridges and metal pickup shall be blended with contour of adjacent surfaces and/or removed.
Axial, galling, scoring	0.015 inch maximum depth, 0.750 inch maximum length. No more than 50% of surface may be marred.	Repair is permissible only for 40% of shaft circumference. Remaining 60% shall be unmarked.	Sharp ridges and metal pickup shall be blended with contour of adjacent surfaces and/or removed.
Corrosion, pits	0.005 inch deep	0.010 inch deep	Refer to WP 402 00.
Paint areas, damage, marred	Not serviceable	See corrective action.	Refer to WP 402 00.
20. No. 2 bearing coupling assembly snap diameter (Diameter U)	Diameter must be 3.1496 to 3.1501 inches.	See corrective action.	Refer to WP 402 00.



1. No pitting allowed on last three threads as shown.

Figure 1. Front Compressor Drive Turbine Shaft - Inspection (Sheet 2 of 2)

3. FRONT COMPRESSOR DRIVE TURBINE SHAFT - CIRCULAR RUNOUT CHECK.

(See Figure 2.)

- a. Mount shaft on Diameters A and B.
- b. Take runout in each area shown. Runout shall be within FIR specified.
- c. If runout readings in 0.004 inch requirement area are between 0.005 to 0.008 inch FIR, recheck readings.

d. If 0.004 inch FIR is still not met, proceed as follows:

- (1) Strip checking areas of SermeTel W paint. Refer to T.O. 2J-F100-53-1, SWP 031 09 (SPOP 203).
- (2) Check reading again.
- (3) If required runouts are achieved, reapply SermeTel W paint. Refer to WP 402 00.
- (4) If required runouts are not met, reject shaft.

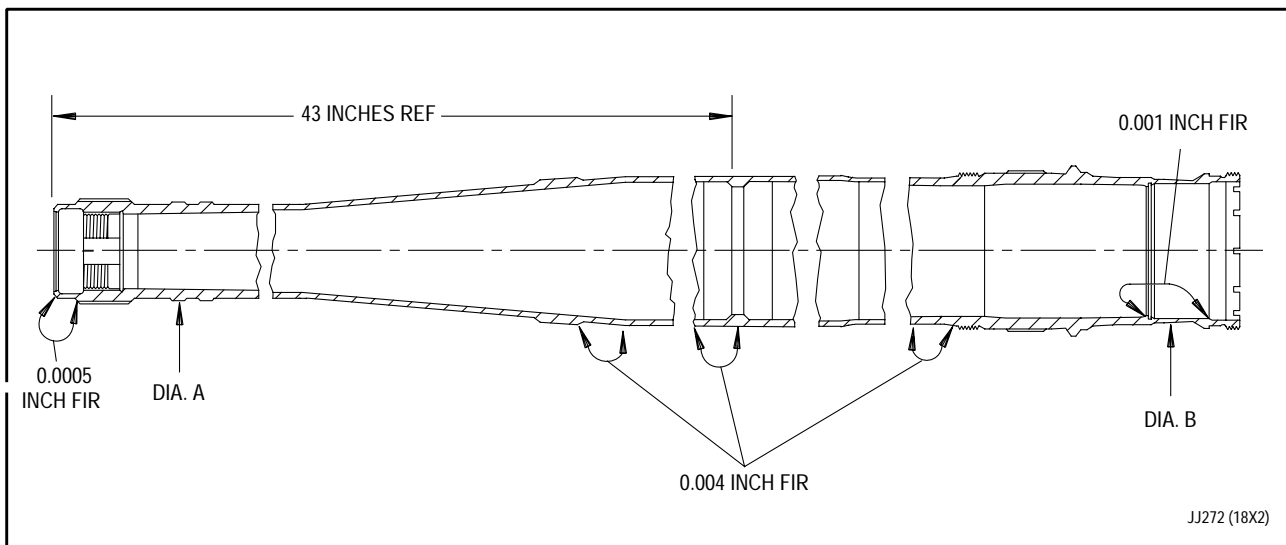


Figure 2. Front Compressor Drive Turbine Shaft Assembly - Circular Runout Check

**4. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - FLUORESCENT PENETRANT
INSPECTION.**

(See Figure 3.)

- a. Fluorescent Penetrant
Inspect(FPI) both OD and ID of
turbine shaft per
T.O. 2J-F100-9, WP 601 00 as
follows:
 - (1) Discontinuities revealed by
FPI shall be accepted only
to limits defined as
follows:
 - (a) No cracks allowed.

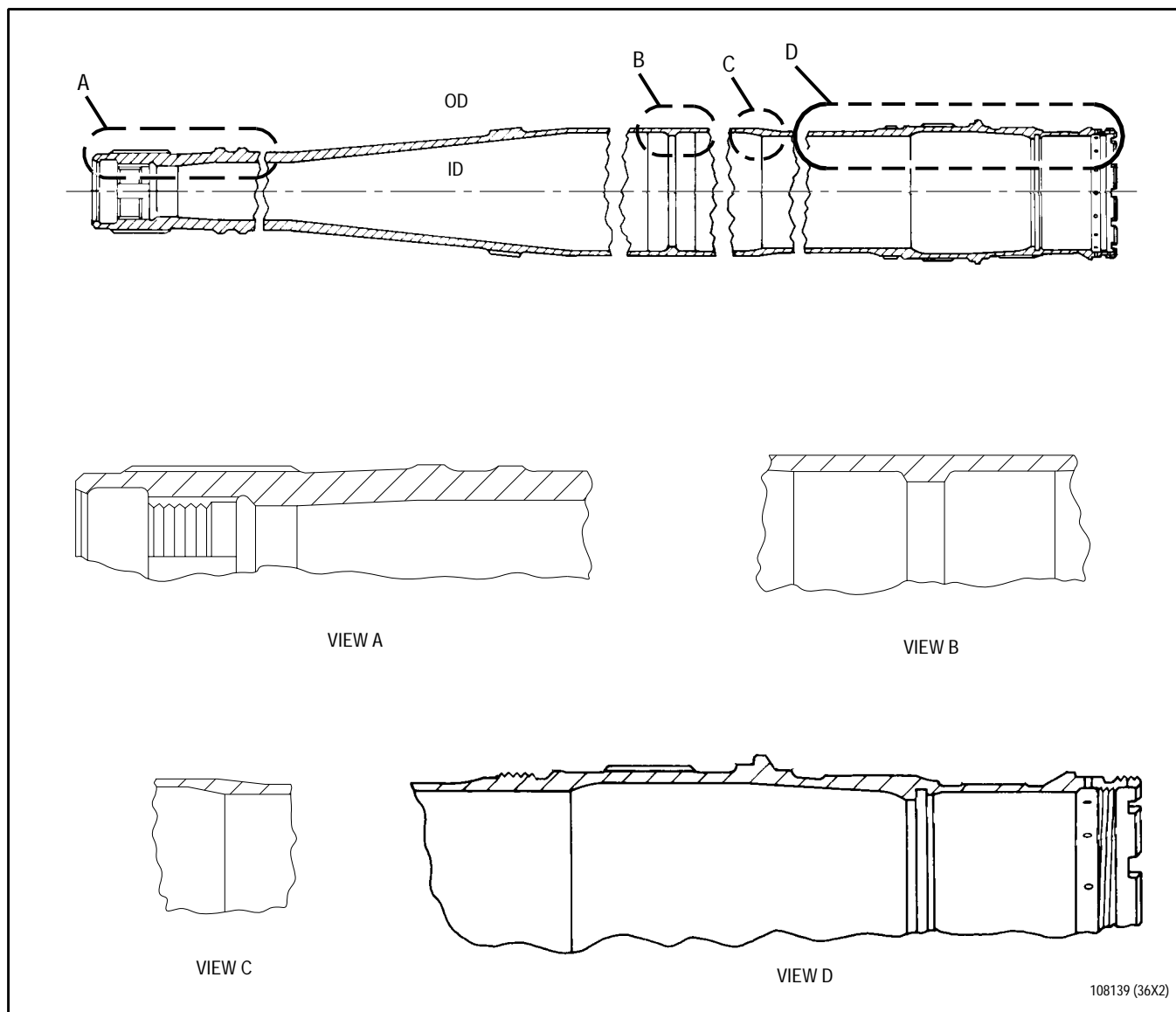


Figure 3. Front Compressor Drive Turbine Shaft - Fluorescent Penetrant Inspection

WORK PACKAGE

TECHNICAL PROCEDURES

RING SEGMENT, ASSEMBLY, AIR SEALING, TURBINE, THIRD STAGE -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	3 - 4	28	5	0
2	0			6	28

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 3rd stage turbine air sealing ring segment assembly.

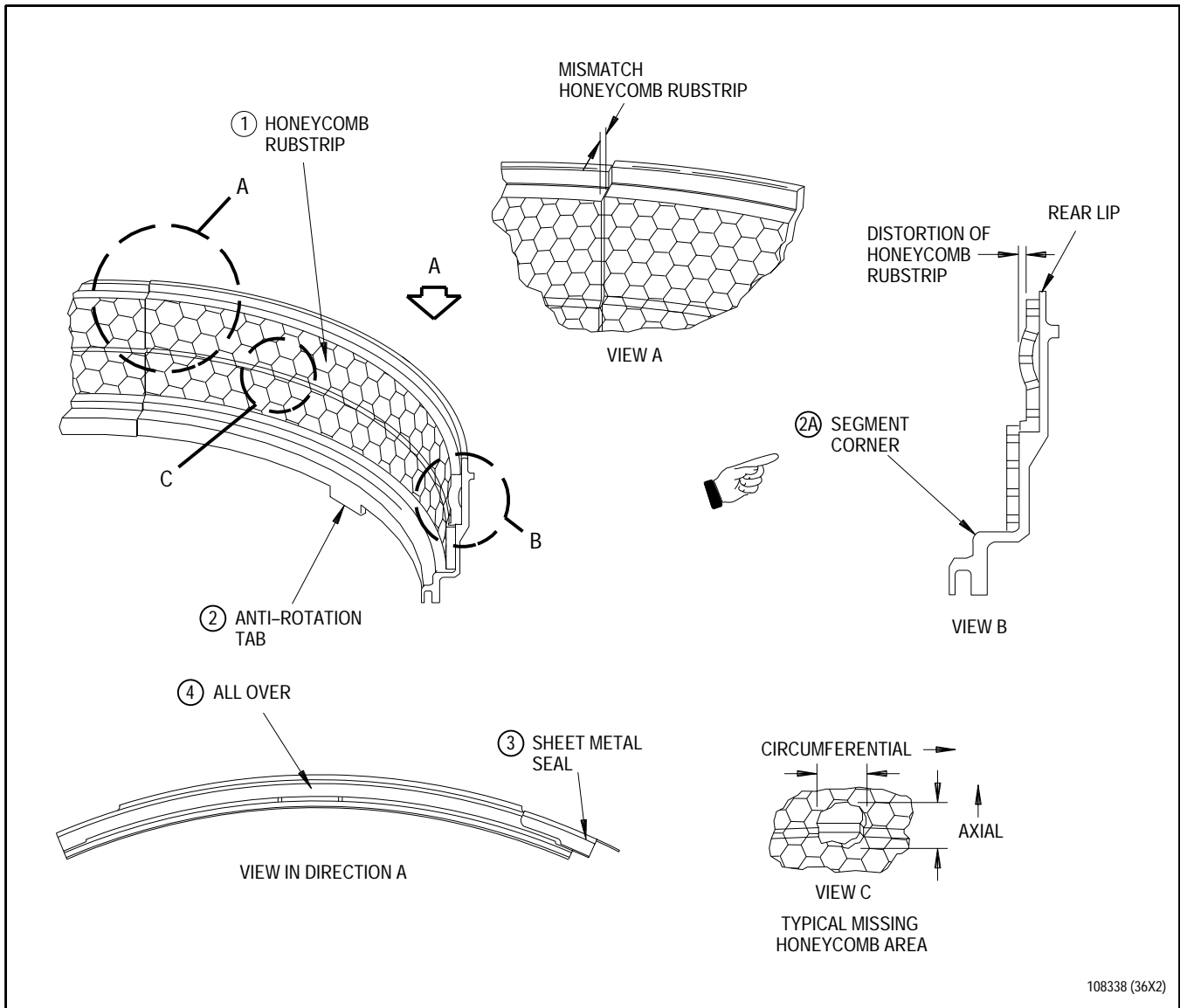
2. THIRD STAGE TURBINE AIR SEALING RING SEGMENT ASSEMBLY - INSPECTION.

(See Figure 1.)

NOTE

No cleaning or inspection required on 3rd stage turbine air sealing ring segment assembly with 4300 cycles or more.

- a. Ensure 3rd stage turbine air sealing ring segment assembly has been cleaned per WP 201 00.
- b. Visually inspect 3rd stage turbine air sealing ring segment assembly. (See figure 1.)
- c. Fluorescent penetrant inspect 3rd stage turbine air sealing ring segment assembly. Refer to T.O. 2J-F100-9. No cracks allowed.



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Honeycomb rubstrip - Grooves	Up to 0.090 inch depth provided no missing honeycomb cells in groove and no grooves in backing plate.	Not reparable	Replace segment assembly.

Figure 1. Third Stage Turbine Air Sealing Ring Segment Assembly - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Honeycomb rubstrip - (continued)			
Distortion	Up to 0.100 inch is acceptable, provided blade tip radial clearance limits are met at assembly.	Not reparable	Replace segment assembly.
Mismatch	0.100 inch at segment ends, provided blade tip radial clearance limits are met at assembly.	Not reparable	Replace segment assembly.

NOTE

- Remove any loose honeycomb before determining total missing area.
- Total area may consist of a series of smaller damaged areas, but maximum axial width of any damaged area is 0.500 inch.

Missing	Axial: On each segment, missing honeycomb is permissible up to 0.500 inch maximum axial width, with total missing area restricted to one square inch. Circumferential: Circumferential length of missing honeycomb area is controlled by axial width. Example for one missing area: 0.250 inch axial width permits 4.000 inch circumferential length.	Not reparable	Replace segment assembly.
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Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
2. Anti-rotation tab -			
Cracks	Maximum 0.100 inch long originating from radius undercut at sides of tab.	Not reparable	Replace segment assembly
2A. Segment corner -			
Blade rub	Not serviceable	Not reparable	Replace segment assembly.
3. Sheet metal seal -			
Wear, chafing	Maximum 0.025 inch including through seal	See corrective action.	Replace seal per WP 403 00.
4. All over -			
Wear, chafing	Up to 0.010 inch deep	Not reparable	Replace segment assembly.
Cracks	Not serviceable	Not reparable	Replace segment assembly.

WORK PACKAGE**TECHNICAL PROCEDURES****CASE ASSEMBLY - TURBINE, REAR -
AND
SUPPORT AND DUCT SET - TURBINE, REAR****INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 14

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	7	28	10 Blank	28
2	0	8 Blank	28	11 - 12 Added	21
3 - 5	28	9	28	13	28
6 Blank	28			14 Blank Added	21

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

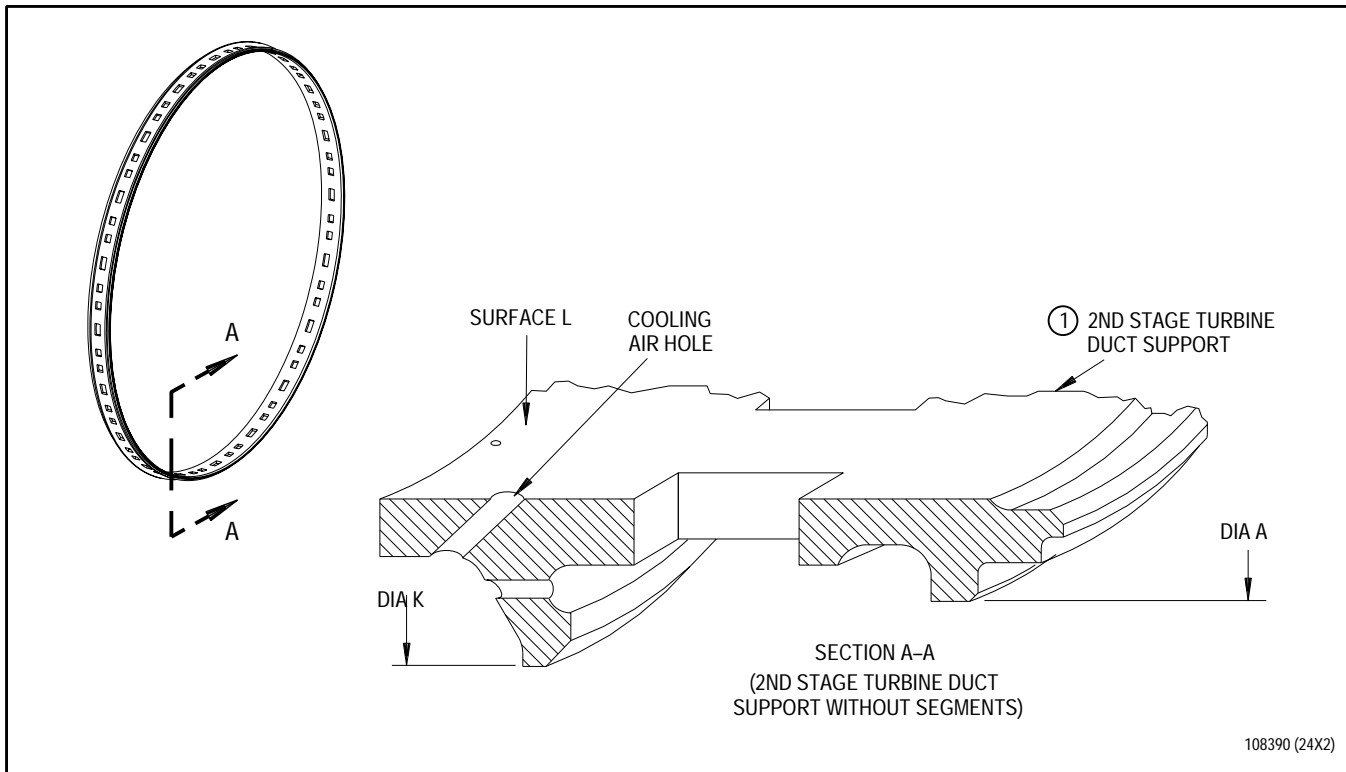
- a. This work package contains instructions for inspection procedures of rear turbine case assembly, rear turbine support and duct set, and rear turbine case and duct set.

2. REAR TURBINE CASE ASSEMBLY AND SUPPORT AND DUCT SET - INSPECTION.

(See Figure 1., 1A. and 2.)

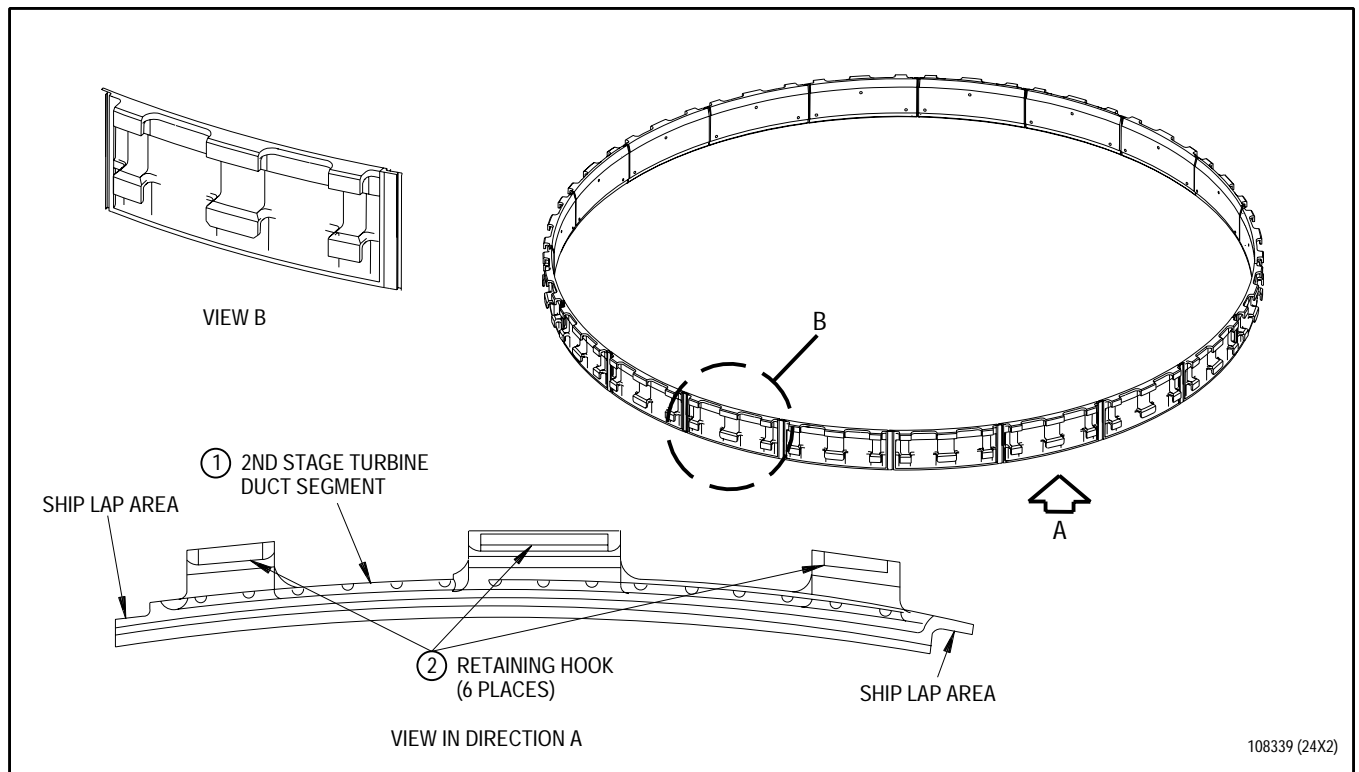
NOTE

- Rear turbine support and duct set can be installed in any rear turbine case assembly.
 - No cleaning or inspection required on rear turbine case assembly and support and duct set, (PN 4071459, 4079210, 4079211, 4077683, 4080000, and 4080043) with 4300 cycles or more.
- a. Ensure rear turbine case assembly, and support and duct set have been cleaned per WP 201 00.
 - b. Remove instrumentation bosses from case before inspecting.
 - c. Fluorescent penetrant inspect rear turbine case for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.
 - d. Refer to figure 2 for visual inspection and limits. Particularly inspect front and rear flange bolt holes, borescope and FTIT boss bolt holes, and flange AE for cracks.
 - e. Surface evaluations should consider the need and limits for repairs. Some conditions are acceptable without repair, however it is desirable to blend repair these areas. The sharper the surface damage, the more desirable it is to blend repair the area. Fluorescent penetrant inspect blend repairs. Refer to T.O. 2J-F100-9.
 - f. Inspect rear turbine case assemblies (PN 4079211 typical) with outer air seal and segment removed per figure 2.



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. 2nd stage turbine duct support - (Support removed from turbine case)			
Cracks from cooling air holes	One crack per hole 0.030 inch maximum length	See corrective action.	Replace support per WP 404 00.
Surface L	Any amount up to 0.010 inch long maximum	See corrective action.	Replace support per WP 404 00.
Diameter K wear, shrinkage	25.823 to 25.829 inch diameter	See corrective action.	Replace support per WP 404 00.
Corrosion (All over)	Not serviceable	See corrective action.	Replace support per WP 404 00.
Diameter A wear, shrinkage	25.554 to 25.559 inch diameter	See corrective action.	Replace support per WP 404 00.
Wear on surface L	Not serviceable	See corrective action.	Replace support per WP 404 00.

Figure 1. Second Stage Turbine Duct Support

**Figure 1A. Second Stage Turbine Duct Segment**

Legend for figure 1A

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. 2nd stage turbine duct segment -			
Wear grooves	Wear grooves caused by turbine blade tip rub must not exceed 0.010 inch deep.	Not reparable	Replace as required per WP 404 00.
Cracks	Not serviceable	Not reparable	Replace as required per WP 404 00.
Surface erosion	Erosion permissible up to 0.005 inch deep over 1/3 of surface.	Not reparable	Replace as required per WP 404 00.
2. Retaining hook -			
Cracks in retaining hook	Not serviceable	Not reparable	Replace as required per WP 404 00.
Wear in rear retaining hook	0.010 inch deep	Not reparable	Replace as required per WP 404 00.
Ship lap area erosion	0.010 inch deep, no cracks allowed	Not reparable	Replace support and duct set per WP 404 00.

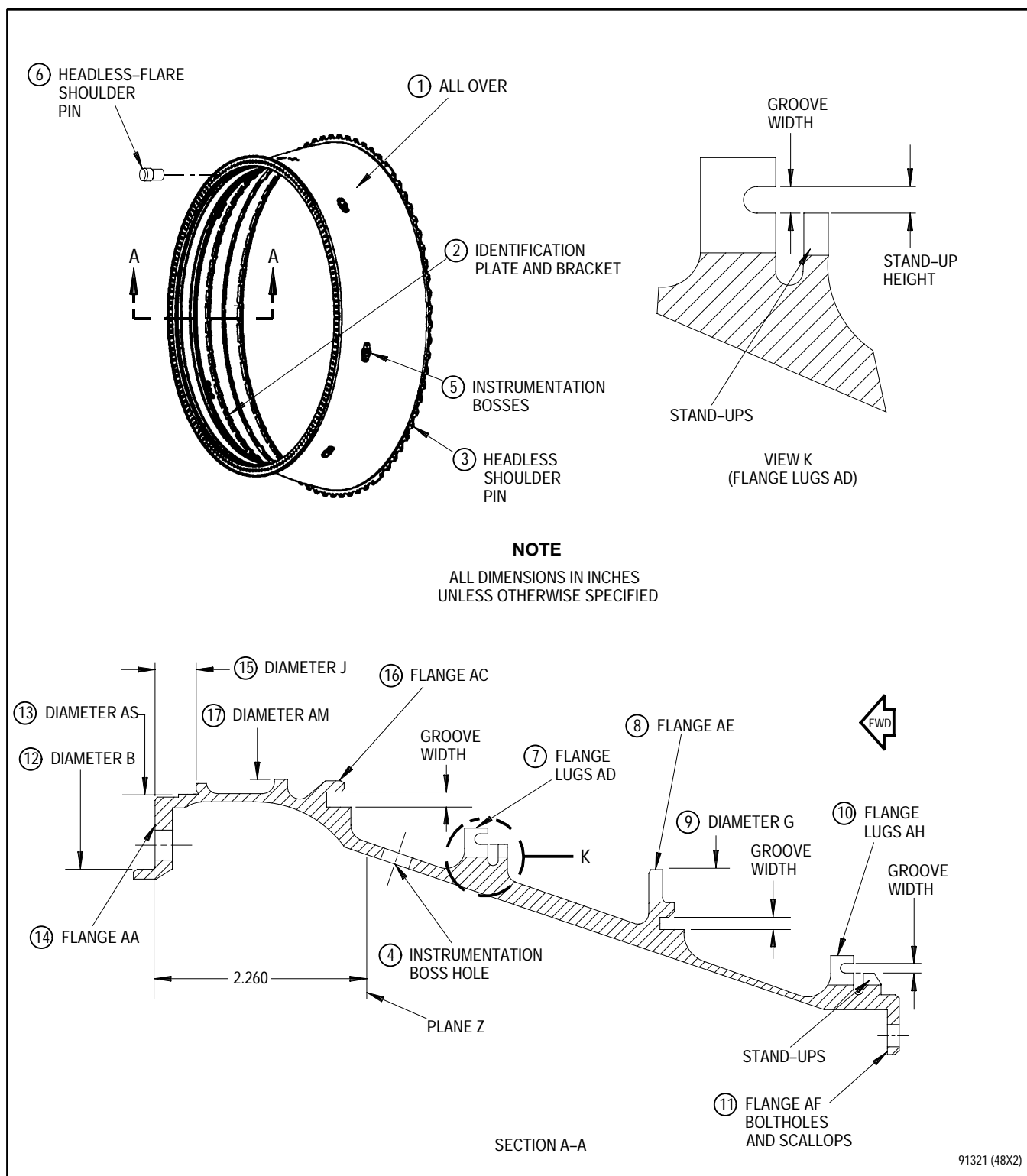


Figure 2. Rear Turbine Case Assemblies (PN 4079211 Typical) - Inspection

Legend for figure 2

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. All over (both sides) -			
Forward of Plane Z:			
Cracks	Not serviceable	Not reparable	Replace case.
Smooth, round dents without cracks	0.020 inch deep, 0.125 inch dia.	Not reparable	Replace case.
Nicks, scratches	Not serviceable	0.005 inch deep	Blend repair per WP 404 00.
Aft of Plane Z:			
Cracks	Not serviceable	See corrective action	Repair per WP 404 00.
Smooth, round dents without cracks	0.020 inch deep, 0.125 inch dia.	See corrective action	Repair per WP 404 00.
Nicks, scratches	Not serviceable	0.005 inch deep	Blend repair per WP 404 00.
2. Identification plate and bracket -			
Cracked, missing	Not serviceable	See corrective action	Replace identification plate and bracket per WP 404 00.
3. Headless shoulder pin -			
Loose, missing	Not serviceable	See corrective action	Replace pin per WP 404 00.
4. Instrumentation boss holes -			
Cracks	Not serviceable	See corrective action	Repair per WP 404 00.
5. Instrumentation bosses -			
Cracked	Not serviceable	See corrective action	Repair per WP 404 00.

Legend for figure 2 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
6. Headless-flare shoulder pin -			
Loose, missing	Not serviceable	See corrective action	Replace pin per WP 404 00.
7. Flange lugs AD -			
Stand-ups height and groove width wear	Up to 0.122 inch maximum	See corrective action	Repair per WP 404 00.
Raised material	Not serviceable	See corrective action	Repair by local blending per WP 404 00.
Side of lug wear	Not serviceable	See corrective action	Repair per WP 404 00.
8. Flange AE -			
Groove width wear	0.132 to 0.136 inch groove width dimension. Up to 0.010 inch deep per surface	See corrective action	Repair per WP 404 00.
Raised material	Not serviceable	See corrective action	Repair by local hand blending per WP 404 00.
9. Diameter G (interrupted diameter) -			
Wear	Wear to 27.586 inches maximum diameter	See corrective action	Repair per WP 404 00.
Raised material	Not serviceable	See corrective action	Repair by local hand blending per WP 404 00.
10. Flange lugs AH -			
Stand-ups height and groove width wear	0.107 inch	See corrective action	Repair per WP 404 00.
Side of lug wear	Up to 0.005 inch wear	See corrective action	Repair per WP 404 00.

Legend for figure 2 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
11. Flange AF, boltholes and scallop -			
Cracks	Not serviceable	See corrective action	Repair per WP 404 00.
Out-of-flat	0.010 inch flat in free state	See corrective action	Repair by local blending per WP 404 00.
12. Diameter B -			
Wear	27.321 inch maximum average diameter	See corrective action	Repair per WP 404 00.
Shrinkage	Minimum of 27.316 inch diameter	Not reparable.	Replace case.
13. Diameter AS -			
Wear	25.823 inch diameter maximum	See corrective action	Repair per WP 404 00.
14. Flange AA -			
Cracks	Not serviceable	Not reparable.	Replace case.
Out-of-flat	0.010 inch flat in free state	Not reparable.	Replace case.
15. Diameter J -			
Wear	0.418 inch at any location around circumference	See corrective action	Repair per WP 404 00.
16. Flange AC -			
Groove width wear	0.142 to 0.146 inch groove width dimension. 0.005 inch deep per surface	See corrective action	Repair per WP 404 00.
Cracks	Not serviceable	See corrective action	Repair by local hand blending per WP 404 00.
17. Diameter AM -			
Wear	25.534 inch diameter maximum	See corrective action	Repair per WP 404 00.

WORK PACKAGE

TECHNICAL PROCEDURES

RING ASSEMBLY - AIR SEALING, TURBINE, THIRD STAGE -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	3	28	4 - 6	0
2	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 3rd stage turbine air sealing ring assembly.

2. THIRD STAGE TURBINE AIR SEALING RING ASSEMBLY - INSPECTION.

(See Figure 1.)

NOTE

No cleaning or inspection required on 3rd stage turbine air sealing ring segment assembly with 4300 cycles or more.

- a. Ensure 3rd stage turbine air sealing ring assembly has been cleaned per WP 201 00.
- b. Visually inspect 3rd stage turbine air sealing ring assembly. (See figure 1.)
- c. Fluorescent penetrant inspect 3rd stage turbine air sealing ring assembly for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.

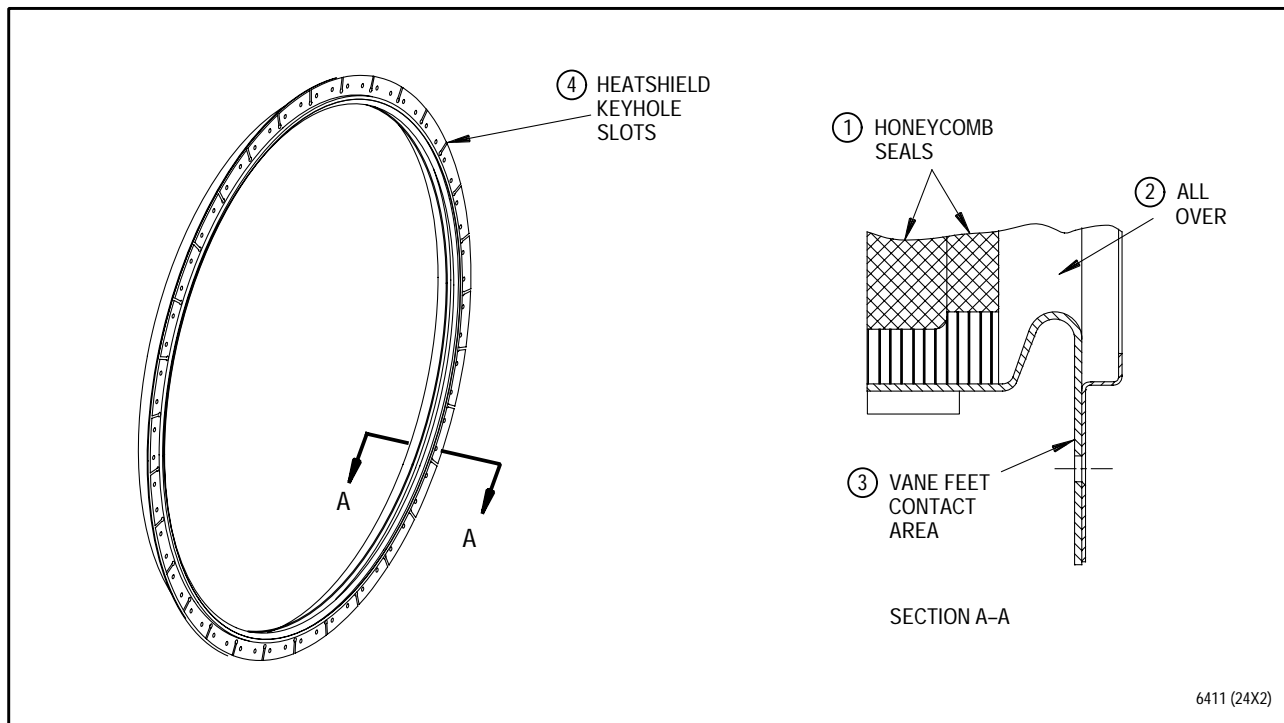


Figure 1. Third Stage Turbine Air Sealing Ring Assembly - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Honeycomb seals -			
Grooves, wear	Up to 0.030 inch deep	Not repairable	Replace air sealing ring assembly.
Roll-over	In two rows only	Not repairable	Replace air sealing ring assembly.
Missing, torn	Not serviceable	Not repairable	Replace air sealing ring assembly.
Unstepping	Not serviceable	Not repairable	Replace air sealing ring assembly.
2. All over (except honeycomb seal) -			
Nicks, dents, and impact damage	a. Up to 0.020 inch deep by 0.300 inch maximum diameter permissible in up to three locations. b. Up to 0.015 inch deep by 0.300 inch maximum diameter permissible in up to eight locations. c. All damage shall be separated by 0.250 inch minimum.	Not repairable	Blend all sharp edges. If damage exceeds serviceable limits, replace air sealing ring assembly.
Scratches	Up to 0.010 inch deep permissible. All damage shall be separated by 0.250 inch minimum.	Not repairable	Replace air sealing ring assembly.
Cracks	Not serviceable	Not repairable	Replace air sealing ring assembly.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3. Vane feet contact area -			
Wear, chafing	Up to 0.010 inch deep maximum.	Not reparable	Replace air sealing ring assembly.
Distortion	Up to 0.040 inch out of normal plane	Not reparable	Replace air sealing ring assembly.
4. Heatshield keyhole slots -			
Cracks	Not serviceable	Not reparable	Replace air sealing ring assembly.

WORK PACKAGE

TECHNICAL PROCEDURES

VANE - TURBINE STATOR, THIRD STAGE -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	3	19	6	0
2	0	4 - 5	28	7 - 8	28

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 3rd stage turbine stator vanes.

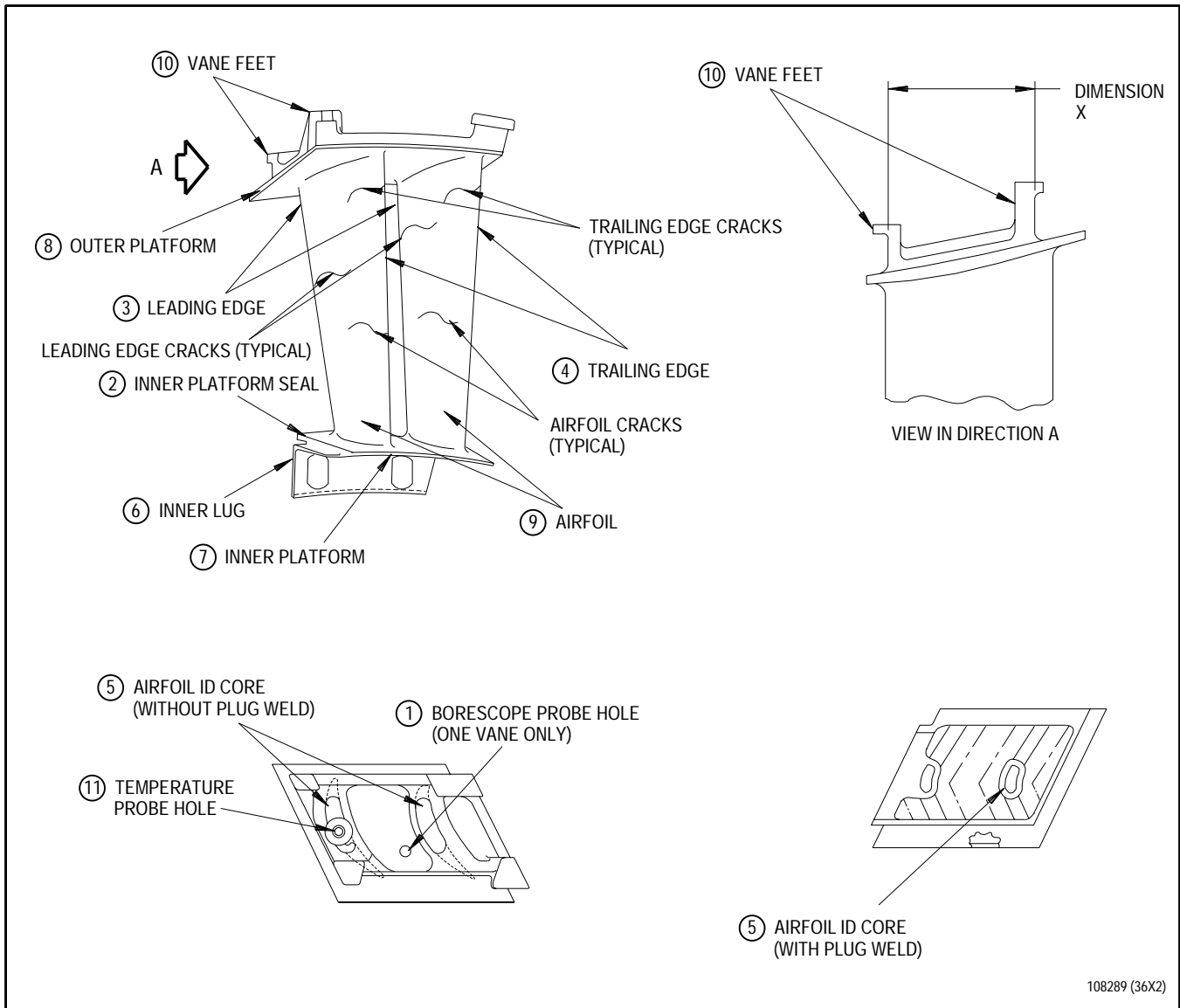
2. THIRD STAGE TURBINE STATOR VANES - INSPECTION.

(See Figure 1.)

NOTE

- No indication is permitted when performing nondestructive inspection of blended areas.
 - Third stage turbine stator vanes are not classed.
 - Unserviceable and replacement vanes shall have the same part number.
- a. Ensure 3rd stage turbine stator vanes have been cleaned per WP 201 00.

- b. Visually inspect 3rd stage turbine stator vanes. (See figure 1.)
- c. Fluorescent penetrant inspect all blended areas of 3rd stage turbine stator vanes.
- d. Fluorescent penetrant inspect 3rd stage turbine stator vanes for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Borescope probe hole - (One vane only)			
Cracks	Not serviceable	Not repairable.	Replace vane.
Blockage	Not serviceable	Any amount	Remove blockage.

Figure 1. Third Stage Turbine Stator Vanes - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
2. Inner platform seals -			
Cracks	Not serviceable without blending.	One crack permitted per seal if crack is not over 0.100 inch long.	Blend per WP 406 00.
Wear, chafing	0.010 inch in depth	Not reparable	Replace vane.
3., Leading and 4. trailing edges -			
Coating	Not serviceable.	See corrective action	Touch up coating per WP 406 00.
Erosion			
Nicks and dents	0.005 inch deep.	a. 0.100 inch deep on trailing edge, except platform to airfoil radius, and leading edge. b. 0.020 inch deep platform to airfoil radius. c. 0.025 inch deep on leading edge. d. Three blends per leading edge or trailing edge of any airfoil.	Blend repair per WP 406 00. Coat after blend per WP 406 00.

NOTE

Leading and trailing edge cracks will make contact with appropriate edge.

Cracks	Not serviceable	Not reparable	Replace vane.
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Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
3., Leading and 4. trailing edges - (continued)			
Deformation (trailing edge only)	Up to 0.015 inch out of plane and 0.250 inch long. No cracks permitted.	Not reparable	Replace vane.
Burning	Not serviceable	Not reparable	Replace vane.
Foreign material splatter	Light spray only. 0.300 inch in diameter per vane, and 0.005 inch above airfoil surface.	Any amount	Grit blast per T.O. 2J-F100-53-1, SWP 031 13. Splatter beyond serviceable limit which cannot be removed by grit blasting shall be blended within repair limits defined for nicks and dents.
5. Airfoil ID core -			
Foreign material	Any amount.	None	Not applicable.
Plug weld cracks	Three cracks per weld no longer than 0.100 inch, each separated by minimum of 0.100 inch.	Not reparable	Replace vane.
Inner platform cracks adjacent to plug weld	Not serviceable.	Not reparable	Replace vane.
Internal corrosion	No noticeable debris, except dirt and soot, should fall from internal cavity when OD of vane is tapped lightly on a hard, clean surface.	Not reparable	Replace vane.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
6. Inner lug -			
Wear, chafing	Groove up to 0.008 inch deep	Not reparable	Replace vane.
7., Inner and outer			
8. platform -			
Cracks	Not serviceable.	Not reparable	Replace vane.
Wear and chafing	0.010 inch deep	Not reparable	Replace vane.
Raised material	Not serviceable	None	Remove raised material. Blend per WP 406 00.
9. Airfoil -			
Coating Erosion	Not serviceable.	See corrective action	Touch-up coating per WP 406 00.
Nicks, dents	0.005 inch deep. 0.300 inch in diameter. No more than one such area per airfoil.	0.010 inch deep. 0.400 inch in diameter. No more than four such areas in any square inch of vane area and no more than seven over airfoil. Airfoil thickness shall not be reduced more than 0.010 inch.	Blend repair per WP 406 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
NOTE			
Airfoil cracks will not make contact with either leading or trailing edge.			
9. Airfoil - (continued)			
Cracks	Not serviceable	Not repairable	Replace vane.
Foreign material splatter	Light spray only. 0.300 inch in diameter, or 0.005 inch above airfoil surface.	Any amount	Grit blast per T.O. 2J-F100-53-1, SWP 031 13. Splatter beyond serviceable limit which cannot be removed by grit blasting shall be blended within limits for nicks and dents.
Burn through	Not serviceable	Not repairable	Replace vane.
10. Vane feet -			
Wear and chafing	0.010 inch deep, Dimension X minimum is 1.280 inches.	Not repairable	Replace vane.
Cracked, missing	Not serviceable	Not repairable	Replace vane.
11. Temperature probe hole (seven 3rd stage vaness only) -			
Blockage	Not serviceable	See corrective action	Remove blockage WP 406 00.
Cracks	Not serviceable	Not repairable	Replace vane.

WORK PACKAGE

TECHNICAL PROCEDURES

VANE - TURBINE STATOR, FOURTH STAGE -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	4 - 7	28	8 Blank	0
2 - 3	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 4th stage turbine stator vanes.

2. FOURTH STAGE TURBINE STATOR VANES - INSPECTION.

(See Figure 1.)

- a. Ensure 4th stage turbine stator vanes have been cleaned per WP 201 00.
- b. Visually inspect 4th stage turbine stator vanes. (See figure 1.)
- c. Fluorescent penetrant inspect all blended areas of 4th stage turbine stator vanes.

- d. Fluorescent penetrant inspect 4th stage turbine stator vanes for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.

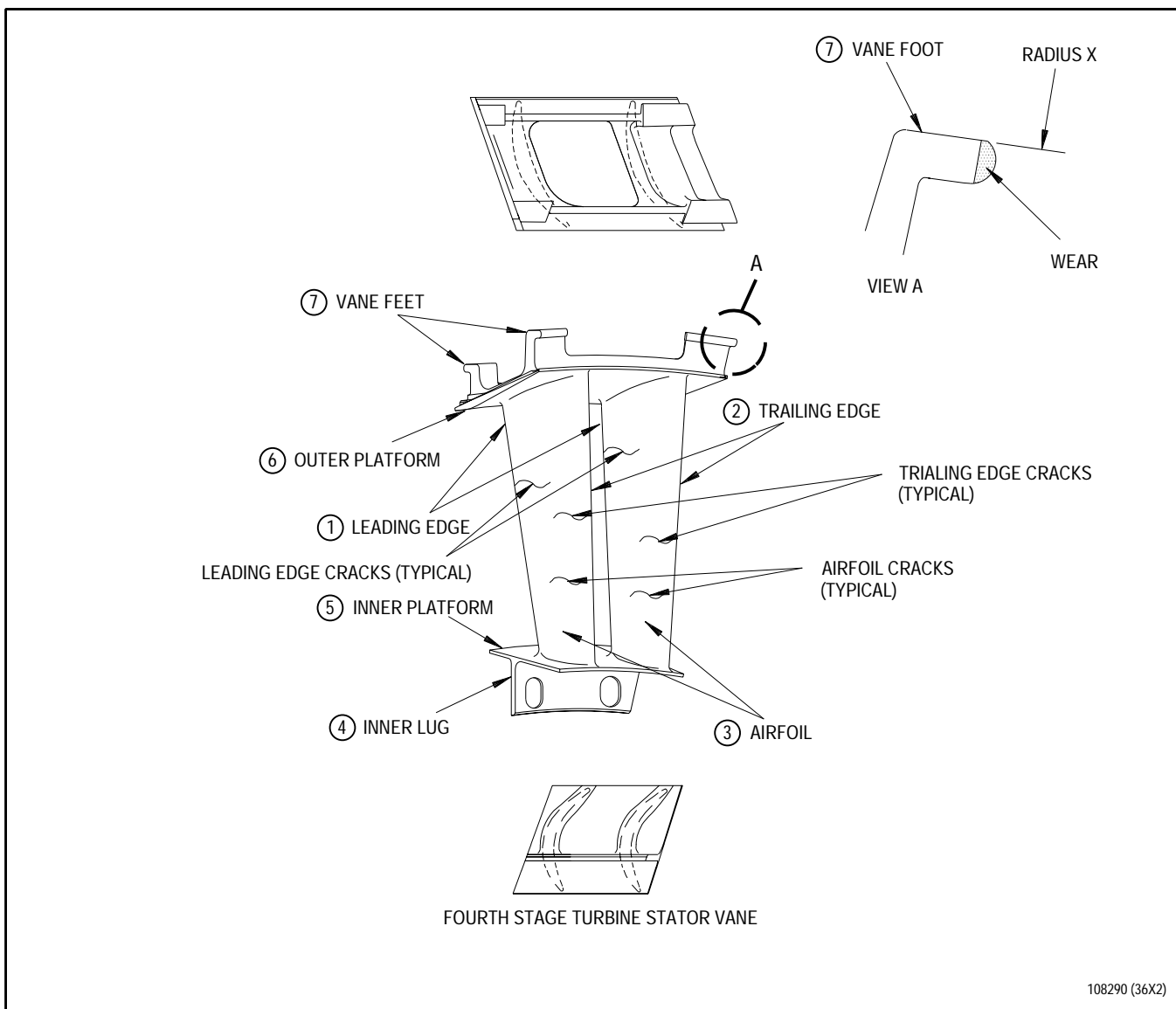


Figure 1. Fourth Stage Turbine Stator Vanes - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1., Leading and 2. trailing edges -			
Nicks and dents	0.010 inch deep	a. 0.100 inch deep except platform to airfoil radius. b. 0.020 inch deep in platform to airfoil radius. c. No more than three blends per leading edge or trailing edge permitted on any one airfoil.	Blend repair per WP 407 00.
Deformation (trailing edge only)	Up to 0.030 inch out of plane. No longer than 0.250 inch. No cracks permitted.	Not repairable	Replace vane.

NOTE

Leading and trailing edge cracks will make contact with appropriate edge.

Cracks	Up to 0.100 inch axial length, two per airfoil, and separated by 0.250 inch.	Not repairable	Replace vane.
Burning	Not serviceable	Not repairable	Replace vane.
Foreign material splatter	Light spray only. No accumulation greater than 0.300 inch in diameter or more than 0.005 inch above airfoil surface.	Any amount	Grit blast. Refer to T.O. 2J-F100-53-1, SWP 031 13. Splatter beyond serviceable limit which cannot be removed by grit blasting shall be blended within limits specified for nicks and dents.
Erosion (leading edge only)	0.020 inch deep	None	Replace vane.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3. Airfoil -			
Nicks, dents	0.005 inch deep. 0.300 inch in diameter. No more than four such areas in any square inch of vane area and a total of seven over airfoil.	0.010 inch deep. 0.400 inch in diameter. No more than four such areas in any square inch of vane area and no more than seven over airfoil. Airfoil thickness shall not be reduced more than 0.010 inch.	Blend repair per WP 407 00.
NOTE			
Airfoil cracks will not make contact with either leading or trailing edge.			
Cracks	Not serviceable	Not repairable	Replace vane.
Foreign material splatter	Light spray only. No accumulation greater than 0.300 inch in diameter or more than 0.005 inch above airfoil surface.	Any amount	Grit blast. Refer to T.O. 2J-F100-53-1, SWP 031 13. Splatter beyond serviceable limit which cannot be removed by grit blasting shall be blended within limits specified for nicks and dents.
Burn through	Not serviceable	Not repairable	Replace vane.
Erosion (leading edge only)	0.020 inch deep	None	Replace vane.
4. Inner lug -			
Wear, chafing	Groove or wear up to 0.020 inch deep	Not repairable	Replace vane.
Nicks, dents	0.030 inch deep. No raised material.	See corrective action	Blend repair per WP 407 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
5. Inner platform -			
Cracks	No more than one crack. No longer than 0.500 inch or wider than 0.010 inch and separated by 0.250 inch. Cracks extending into airfoil fillet radius are not serviceable.	Not repairable	Replace vane.
Wear and chafing	0.020 inch deep	Not repairable	Replace vane.
6. Outer platform -			
Cracks	No longer than 0.250 inch or wider than 0.005 inch and separated by 0.250 inch. Cracks extending into airfoil fillet radius are not serviceable.	Not repairable	Replace vane.
Wear and chafing	0.010 inch in deep	Not repairable	Replace vane.
7. Vane feet -			
Wear and chafing (all over, except radius X)	0.005 inch deep	Not repairable	Replace vane.
Cracked, missing	Not serviceable	Not repairable	Replace vane.
Radius X	0.035 inch radius remaining	Not repairable	Replace vane.

WORK PACKAGE

TECHNICAL PROCEDURES

RING ASSEMBLY - AIR SEALING, TURBINE, THIRD STAGE (INNER) -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	19	3	18	4	19
2	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 3rd stage turbine air sealing ring assembly.

2. THIRD STAGE TURBINE AIR SEALING RING ASSEMBLY (INNER) - INSPECTION.

(See Figure 1.)

- a. Ensure 3rd stage turbine air sealing ring assembly has been cleaned per WP 201 00.
- b. Visual inspect 3rd stage turbine air sealing ring assembly. (See figure 1.)

- c. Fluorescent penetrant inspect 3rd stage turbine air sealing ring assembly for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.

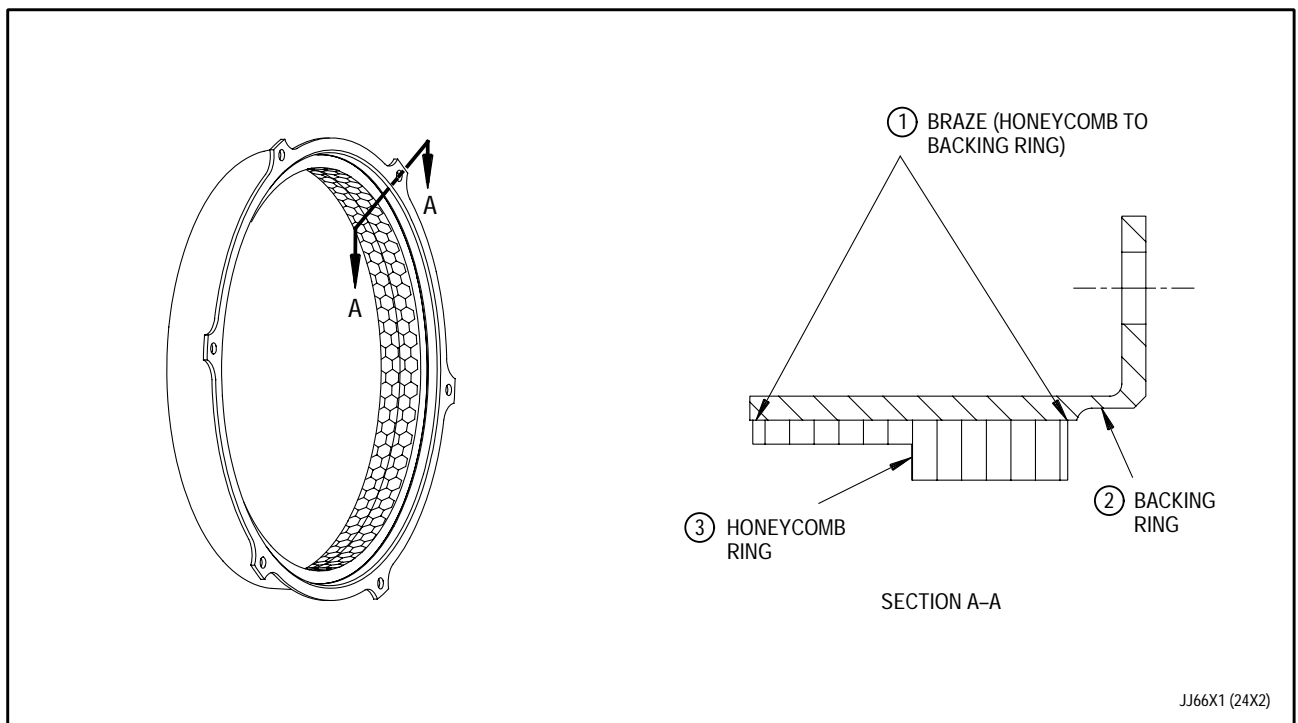


Figure 1. Third Stage Turbine Air Sealing Ring Assembly (Inner) - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Braze (Honeycomb to backing ring) - Honeycomb separation from backing ring	Serviceable provided separation does not extend over 6.500 inches of circumference no restriction for depth of separation.	Not repairable	Replace 3rd stage turbine air sealing ring assembly.
2. Backing ring - Nicks, dents, and scratches	Not serviceable	Up to 0.005 inch deep	Blend. Refer to T.O. 2J-F100-53-9, WP 408 00.
Cracks	Not serviceable	Not repairable	Replace 3rd stage turbine air sealing ring assembly.
3. Honeycomb ring - Grooving	Serviceable up to 0.050 inch deep and 0.250 inch wide	Any amount	Replace honeycomb per WP 408 00.
Rolled over area	360 degrees on front edge of all lands. Two rows (of honeycomb cells) only.	Any amount	Replace honeycomb per WP 408 00.
Holes in sides of honeycomb cells	Serviceable up to 0.093 inch diameter	Any amount	Replace honeycomb per WP 408 00.

WORK PACKAGE

TECHNICAL PROCEDURES

RING ASSEMBLY - AIR SEALING, TURBINE, FOURTH STAGE -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	3	28	4 - 5	0
2	0			6 Blank	0

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 4th stage turbine air sealing ring assembly.

2. FOURTH STAGE TURBINE AIR SEALING RING ASSEMBLY - INSPECTION.

(See Figure 1.)

NOTE

No cleaning or inspection required on fourth stage turbine air sealing ring assembly with 4300 cycles or more.

- a. Ensure 4th stage turbine air sealing ring assembly has been cleaned per WP 201 00.
- b. Inspect 4th stage turbine air sealing ring assembly. (See figure 1.)
- c. Fluorescent penetrant inspect 4th stage turbine air sealing ring assembly for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.

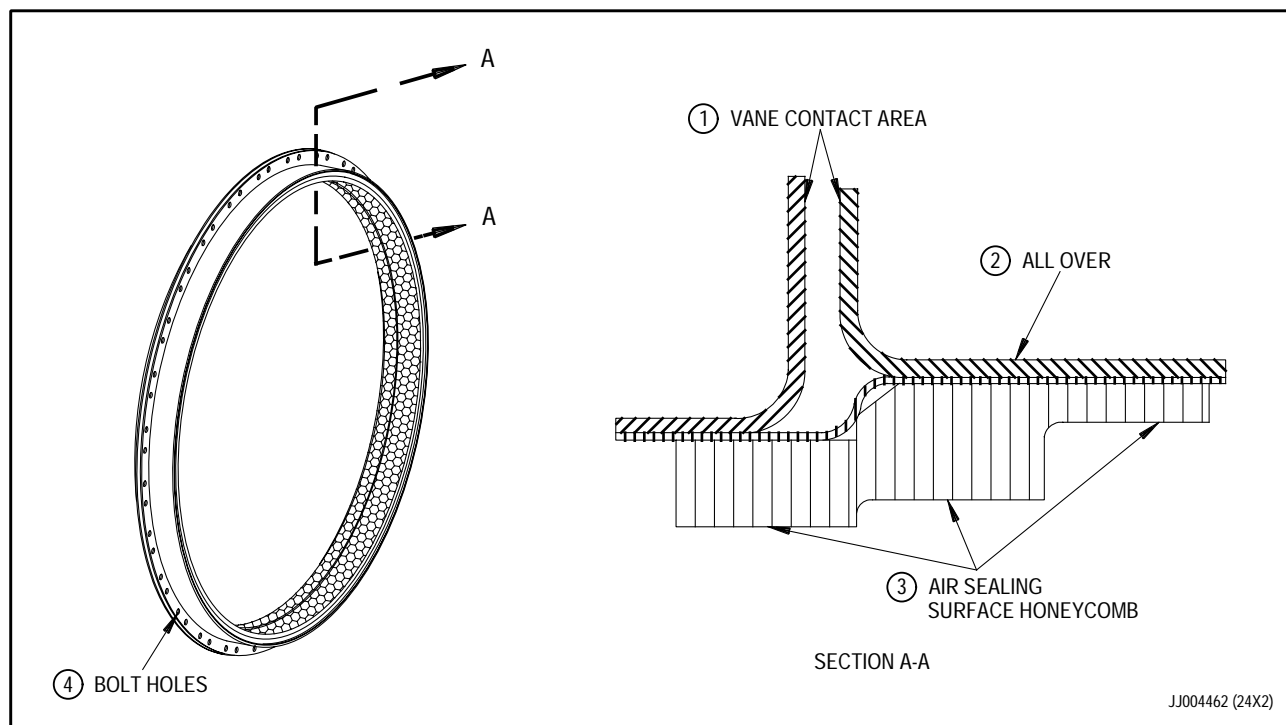


Figure 1. Fourth Stage Turbine Air Sealing Ring Assembly - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Vane contact area -			
Wear, chafing	Up to 0.010 inch deep	Not reparable	Replace air sealing ring.
2. All over (except air sealing ring surface) -			
Cracks	Not serviceable	Not reparable	Replace air sealing ring.
Nicks, dents, impact damage	Not serviceable	See corrective action.	Blend repair per WP 409 00.
Scratches	Not serviceable	See corrective action.	Blend repair per WP 409 00.
3. Air sealing surface honeycomb -			
Grooves, wear	Grooves resulting from knife-edge rub are not allowable into backing plate.	Not reparable	Replace air sealing ring.
4. Bolt holes -			
Cracks	Not serviceable	Not reparable	Replace air sealing ring.

WORK PACKAGE**TECHNICAL PROCEDURES****AIR SEAL, TURBINE, THIRD STAGE -****INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 10

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	30	4	27	7 - 8 Added	18
2	27	5 - 6	30	9 Added	27
3	0			10 Blank Added	27

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Air Seal, Turbine, Third and Fourth Stages - Repair - - -	WP 410 00
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 3rd stage turbine air seal.

2. THIRD STAGE TURBINE AIR SEAL - INSPECTION.

(See Figures 1 through 4.)

- a. Ensure 3rd stage turbine air seal has been cleaned per WP 201 00.
- b. Visually inspect 3rd stage turbine air seal. (See figures 1 and 4.)
- c. Fluorescent penetrant inspect 3rd stage turbine air seal for cracks on a system with capability defined in figure 2. Refer to T.O. 2J-F100-9. No cracks allowed. All crack indications observed are cause for rejection and require Material Review Board (MRB) evaluation. (See figure 2.)
- d. Eddy current inspect 3rd stage turbine air seal per requirements of figure 3. Refer to T.O. 2J-F100-9.

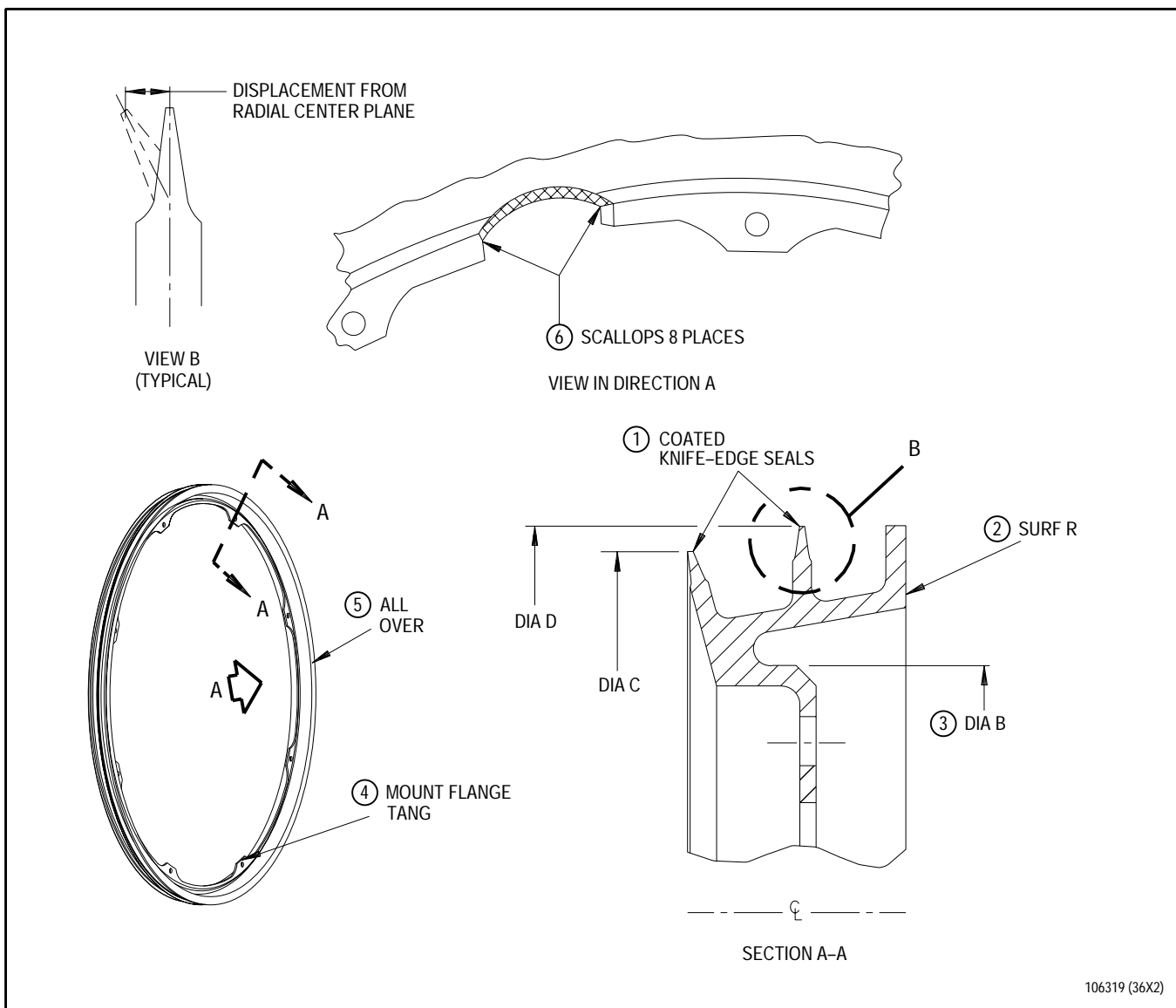


Figure 1. Third Stage Turbine Air Seal - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Coated knife-edge seals -			
Wear	Average minimum diameters: Diameter C 16.531 inches, Diameter D 16.731 inches	Average minimum diameters: Diameter C 16.527 inches, Diameter D 16.727 inches	Strip and recoat per WP 410 00.
Nicks and dents	Not serviceable	Reparable if final blend meets blend limits in WP 410 00	Blend repair per WP 410 00.
Cracks	Not serviceable	Not reparable	Replace 3rd stage turbine air seal.
Bent	0.500 inch long per knife edge. 0.050 inch maximum displacement from radial center plane	Reparable if final blend meets blend limits in WP 410 00	Blend repair per WP 410 00.
Chipped or missing coating	Visible as lost top coating missing from bond coat layer by defined lines of demarcation. See figure 4. Coating may be chipped or missing in up to six 0.250 inch long areas, but shall be separated by at least one inch per knife-edge.	Any amount	Strip and recoat per WP 410 00.
2. Surface R -			
Nicks and dents	Not serviceable	Up to 0.002 inch deep.	Blend repair per WP 410 00.
Raised material	Not serviceable	Any amount	Blend repair per WP 410 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3. Diameter B - Wear	Refer to WP 801 00, Reference 4141.	Not repairable	Replace third stage air seal.
4. Mount flange tangs - Burning, erosion	Not serviceable	Not repairable	Replace third stage air seal.
Bent	0.025 inch out of plane (as measured from tip)	Not repairable	Replace third stage air seal.
5. All over - (except as noted)			
Nicks, dents	0.007 inch deep	Up to 0.010 inch deep	Blend repair per WP 410 00.
Cracks	Not serviceable	Not repairable	Replace third stage air seal.
6. Scallops			
Nicks, dents	Not serviceable	Not repairable	Replace third stage air seal.

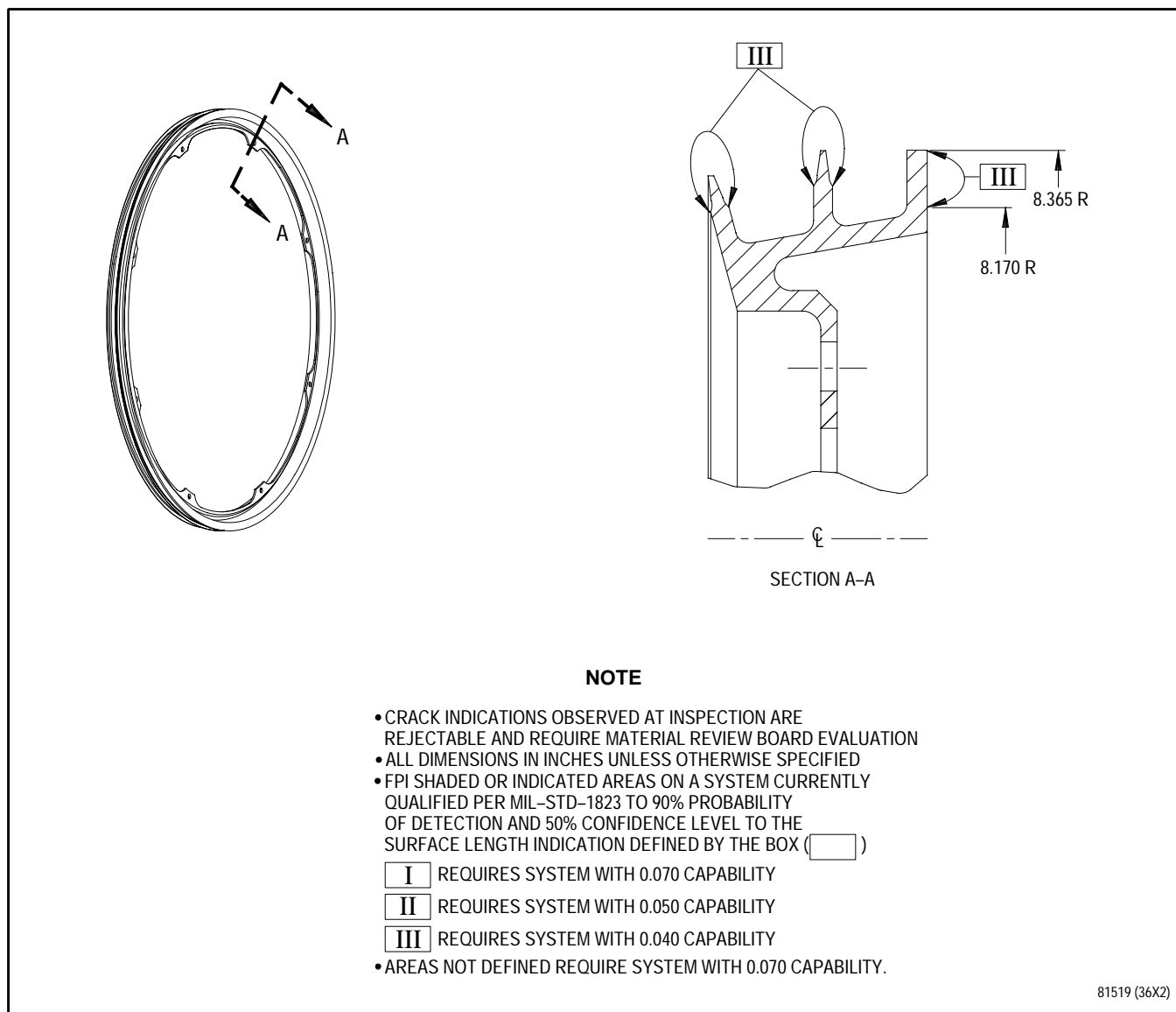
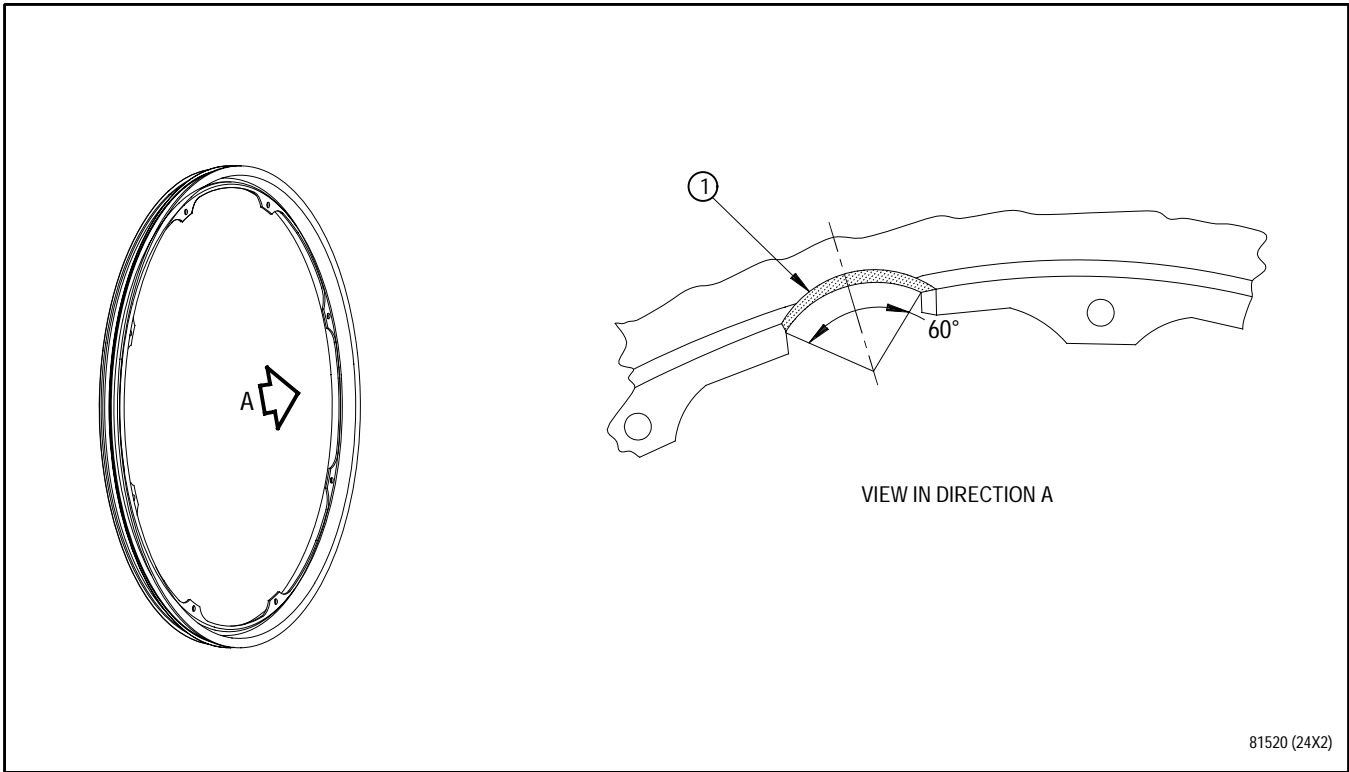


Figure 2. Third Stage Turbine Air Seal - Required Fluorescent Penetrant System Capability



Inspection Area	*Maximum Flaw Depth (Inch)	Flaw Surface Orientation	SRL System Rejection Limits		Corrective Action
			(Counts)	(A50-inch)	
1. Cooling air slots, 8 places-	0.005	Radial	TBD	TBD	Replace third stage turbine air seal.

*Eddy current inspect on system currently qualified per MIL-STD-1823 at 90% probability of detection and 50% confidence level for required flaw depth.

Figure 3. Third Stage Turbine Air Seal - Eddy Current Inspection

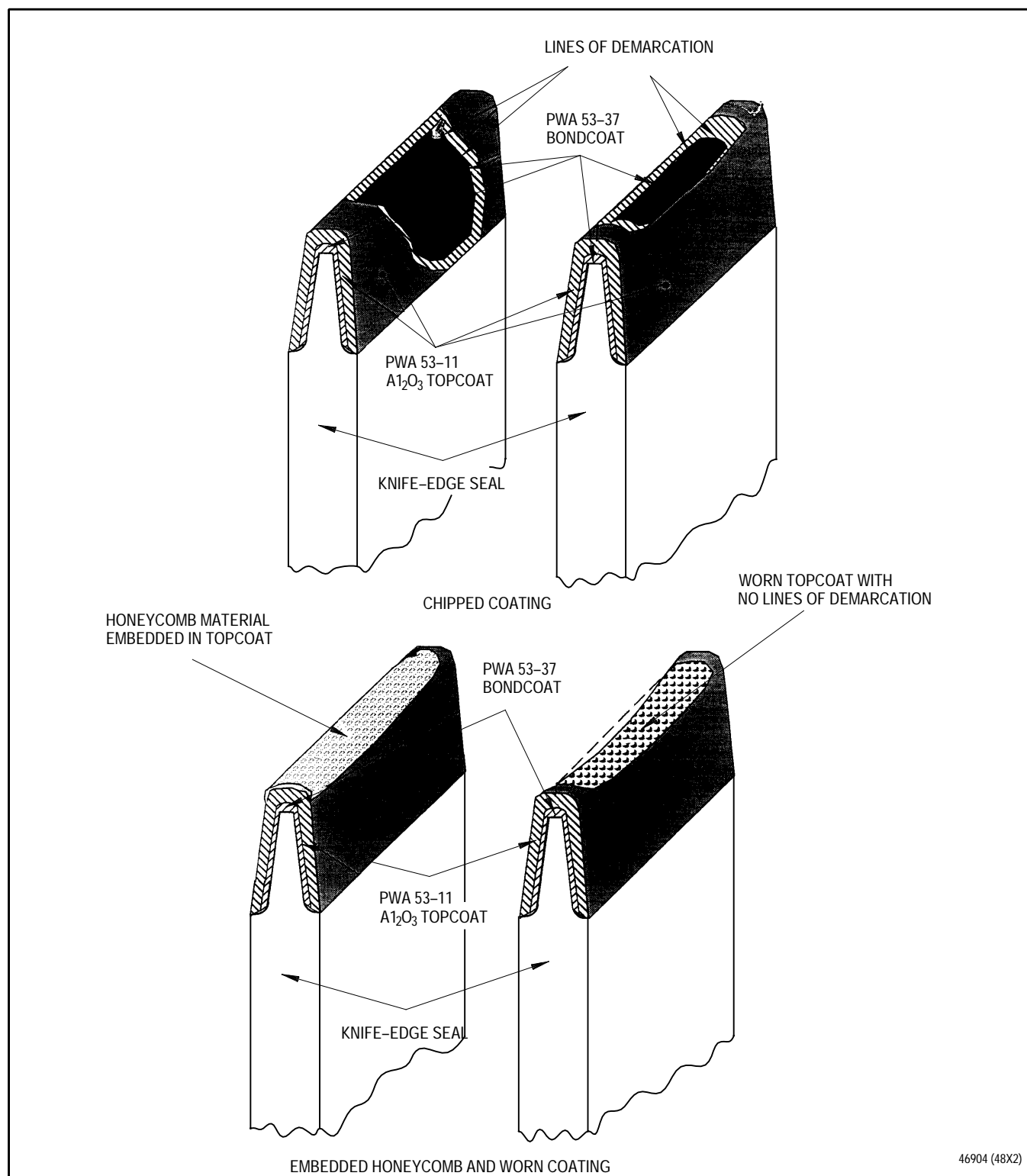


Figure 4. Third Stage Turbine Air Seal - Chipped Coating, Embedded Honeycomb, and Worn Coating

WORK PACKAGE

TECHNICAL PROCEDURES

RING - RETAINING, FOURTH STAGE TURBINE STATOR -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	0				
4 Blank	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

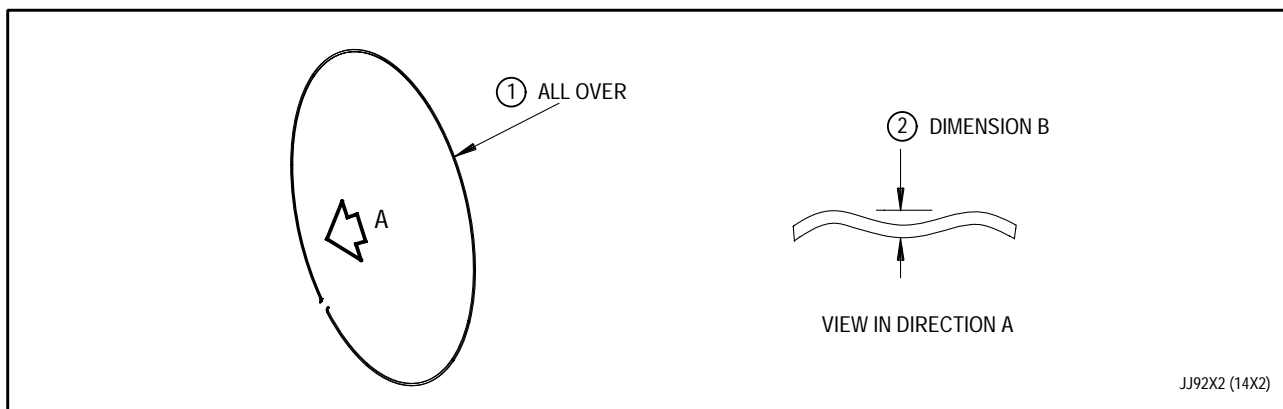
None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 4th stage turbine stator retaining ring.

2. FOURTH STAGE TURBINE STATOR RETAINING RING - INSPECTION.

(See Figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. All over -			
Cracks	Not serviceable	Not repairable	Replace ring.
Wear	Up to 0.020 inch deep	Not repairable	Replace ring.
2. Dimension B			
Distortion	Up to 0.160 inch	Not repairable	Replace ring.

Figure 1. Fourth Stage Turbine Stator Retaining Ring - Inspection

WORK PACKAGE**TECHNICAL PROCEDURES****DISK - TURBINE, THIRD STAGE -****INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 18

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	30	4B Blank Added	30	6A - 6D	30
2A - 2B Added	22	5	0	7 - 8	22
3 - 4	30	6	18	9 Added	22
4A Added	30			10 Blank Added	22

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Nondestructive Inspection Procedure (Repetitive) - Eddy	
Current - - - - -	SWP 004 09
Disk, Turbine, 3rd Stage - Inspection - - - - -	SWP 609 01
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module Parts - Cleaning - - - - -	WP 201 00
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature

Cloth, abrasive crocus

Specification/Vendor Part Number

P-C-458

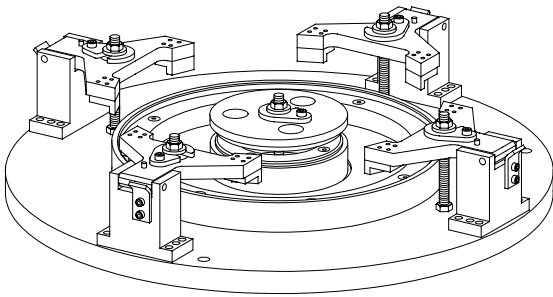
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

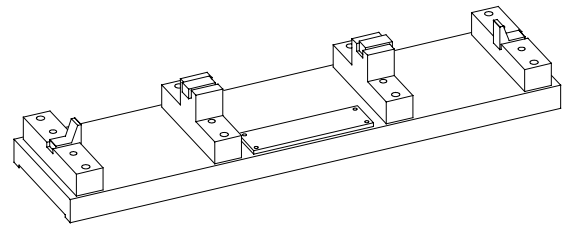
Paragraph	Function - Tool Nomenclature	Tool Number
3	THIRD STAGE TURBINE DISK PN 4080603 AND 4084103 - SNAP DIAMETER MEASUREMENT	
	FIXTURE, CONSTRAINT, 3RD STAGE TURBINE DISK, FRONT - - - - -	PWA 57866
	MASTER, GAGE, 3RD STAGE TURBINE DISK, FRONT - - - -	PWA 57867
	GAGE, 3RD STAGE TURBINE DISK, FRONT INNER SNAP DIAMETER - - - - -	PWA 57868
	GAGE, 3RD STAGE TURBINE DISK, FRONT OUTER SNAP DIAMETER - - - - -	PWA 57869
	PYROMETER, COMPRESSOR AND TURBINE DISKS/HUBS - - - -	SAALC 8041732
	DIGITAL DISPLAY UNIT, COMPRESSOR AND TURBINE DISKS/ HUBS - - - - -	SAALC 8041733
	FIXTURE, CONSTRAINT, 3RD STAGE TURBINE DISK, REAR	PWA 57870
	MASTER, GAGE, 3RD STAGE TURBINE DISK, REAR - - - -	PWA 57871
	GAGE, 3RD STAGE TURBINE DISK, REAR INNER SNAP DIAMETER - - - - -	PWA 57872
	GAGE, 3RD STAGE TURBINE DISK, REAR OUTER SNAP DIAMETER - - - - -	PWA 57873

ILLUSTRATED SUPPORT EQUIPMENT



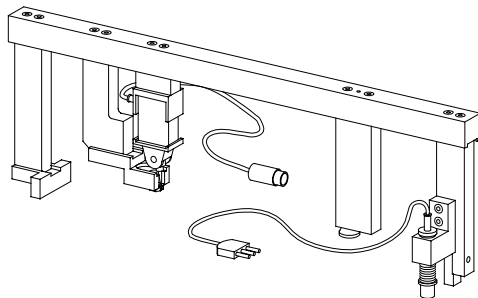
PWA 57866 -C

Figure T1. PWA 57866 FIXTURE



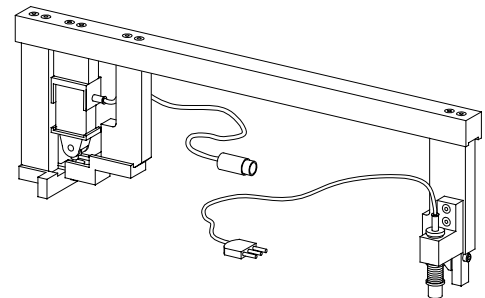
PWA 57867 -C

Figure T2. PWA 57867 MASTER



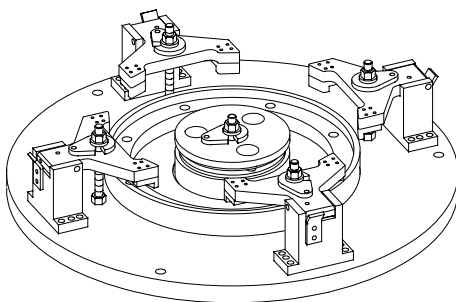
PWA 57868 -C

Figure T3. PWA 57868 GAGE



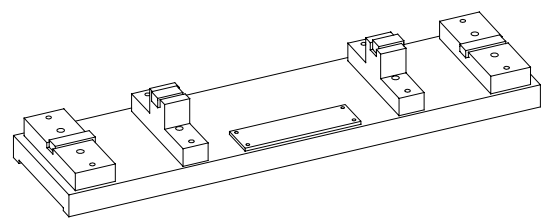
PWA 57869 -C

Figure T4. PWA 57869 GAGE



PWA 57870 -C

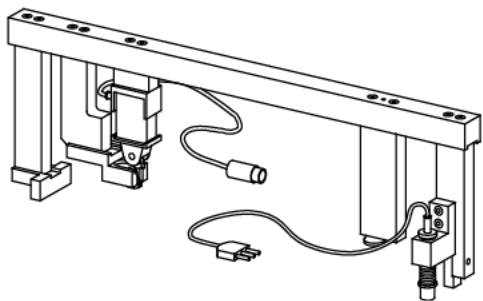
Figure T5. PWA 57870 FIXTURE



PWA 57871 -C

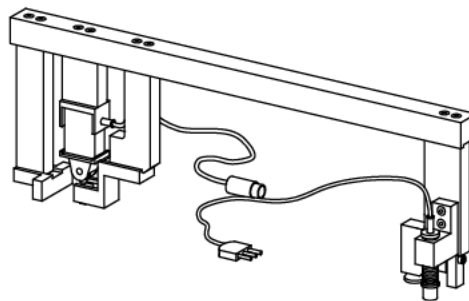
Figure T6. PWA 57871 MASTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



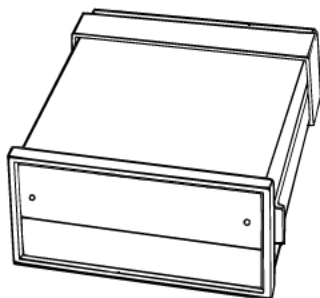
PWA 57872 -C

Figure T7. PWA 57872 GAGE



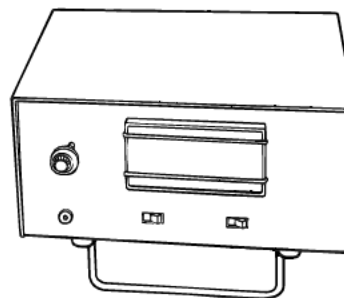
PWA 57873 -C

Figure T8. PWA 57873 GAGE



SAALC 8041732 -C

Figure T9. SAALC 8041732 PYROMETER



SAALC 8041733 -C

**Figure T10. SAALC 8041733 DIGITAL DISPLAY
UNIT**

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 3rd stage turbine disk.

2. THIRD STAGE TURBINE DISK - INSPECTION.

(See Figures 1 through 3.)



Failure to replace front compressor drive turbine and stator assembly that has undergone an overspeed may result in engine failure.

NOTE

Any low turbine having exceeded 11,500 rpm for 1/2 second or more is considered to have undergone an overspeed.

- a. Replace front compressor drive turbine rotor and stator assembly considered to have undergone an overspeed.
- b. Clean disk immediately before inspection per WP 201 00.



Presence of cracks or other unusual conditions confirmed by visual examination or nondestructive inspection are cause for rejection; unserviceable conditions can result in engine damage.

- c. Visually inspect 3rd stage turbine disk using fluorescent (white) light and a 10X magnifying glass for surface damage. Depth of damage, especially on curved areas or areas which are difficult to observe, may be more easily determined by comparison with samples having known depths. If disk has been blend-repaired, perform nondestructive inspections. Refer to T.O. 2J-F100-9.

- d. Pay particular attention to areas where defects are difficult to find, such as tierrod, counterweight and lightening holes, and to critical areas such as blade slots and bore.
- e. Fluorescent penetrant inspect 3rd stage turbine disk for cracks on a system with capability defined in figure 2. See figure 2. No cracks allowed.
- f. Rework of any disk that has a crack or any indication not clearly the result of localized damage such as nicks, dents, or scratches is not permissible.
- g. Evaluation of surface should take into consideration need for repairs and limits to which repairs may be made. Some conditions are acceptable without repairs; however, it is desirable to blend repair these areas. The sharper the surface damage, the more desirable it is to blend area. Nondestructive inspect blend repairs. Refer to T.O. 2J-F100-9.
- h. Acceptability and reparability of specific areas shall be made. (See figure 1.)
- i. Measure 3rd stage turbine disk PN 4080603 or 4084103 snap diameters per paragraph 3.
- j. Perform stretch measurement per paragraph 4.
- k. Eddy current inspect 3rd stage turbine disk per requirements of paragraph 2A and figure 3. Refer to T.O. 2J-F100-9.

2A. EDDY CURRENT INSPECTION USING PN 112366, FULLY AUTOMATED EDDY CURRENT INSPECTION STATION VERSION 3 FOR DISK, TURBINE, 3RD STAGE PN'S 4084103, 4084228, AND 4084231.

(See Figure 3.)

- a. Ensure that turbine disk has been cleaned per WP 201 00.
- b. Prepare ECIS and inspect part.
Refer to T.O. 2J-F100-9,
SWP 004 09 and SWP 609 01.
- c. Evaluate inspection results per figure 3.

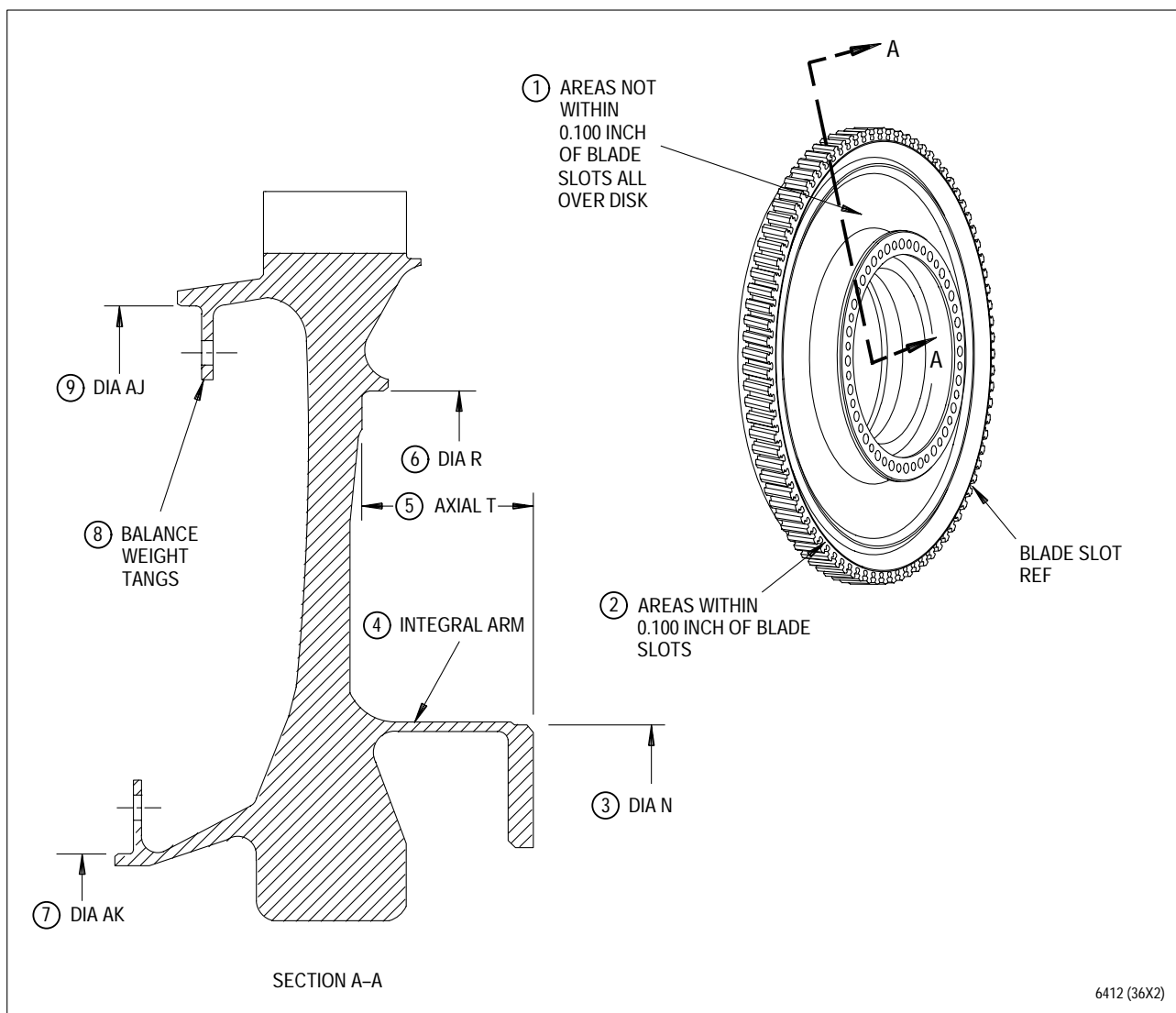


Figure 1. Third Stage Turbine Disk - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. Areas not within 0.100 inch of blade slots all over disk -			
Cracks	Not serviceable	Not reparable	Replace disk.
Nicks, dents	Not serviceable	0.005 inch deep	Blend repair. Refer to T.O. 2J-F100-53-9, WP 412 00.
Scratches	Not serviceable	a. 0.005 inch deep b. One inch long	Blend repair. Refer to T.O. 2J-F100-53-9, WP 412 00.
Corrosion	Not serviceable	a. 0.002 inch deep b. Two square inches	Blend repair. Refer to T.O. 2J-F100-53-9, WP 412 00.
2. Areas of disk within 0.100 inch of blade slots -			
Nicks, dents, scratches	Not serviceable	0.005 inch deep	Blend repair. Refer to T.O. 2J-F100-53-9, WP 412 00.
Cracks	Not serviceable	Not reparable	Replace disk.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3. Diameter N -			
Wear	Per WP 801 00, Reference 4116.	Not reparable	Replace disk.
4. Integral arm -			
Circumferential cracks	Not serviceable	Not reparable	Replace disk.
5. Axial dimension T -			
Wear	Per WP 801 00, Reference 4143.	Not reparable	Replace disk.
6. Diameter R -			
Wear	Per WP 801 00, Reference 4159.	Not reparable	Replace disk.
Stretch	Inspect per paragraph 3.		
7. Diameter AK -			
Wear	Per WP 801 00, Reference 4112.	Not reparable	Replace disk.
8. Balance weight tangs -			
Bent	0.025 inch out of plane (as marked from tip)	Any amount provided no cracks present	Remove tang per WP 412.
Missing (removed)	Serviceable	See corrective action	None.
Cracks	Not serviceable	Not reparable	Replace disk.
9. Diameter AJ -			
Wear	Per WP 801 00, Reference 4141.	Not reparable	Replace disk.

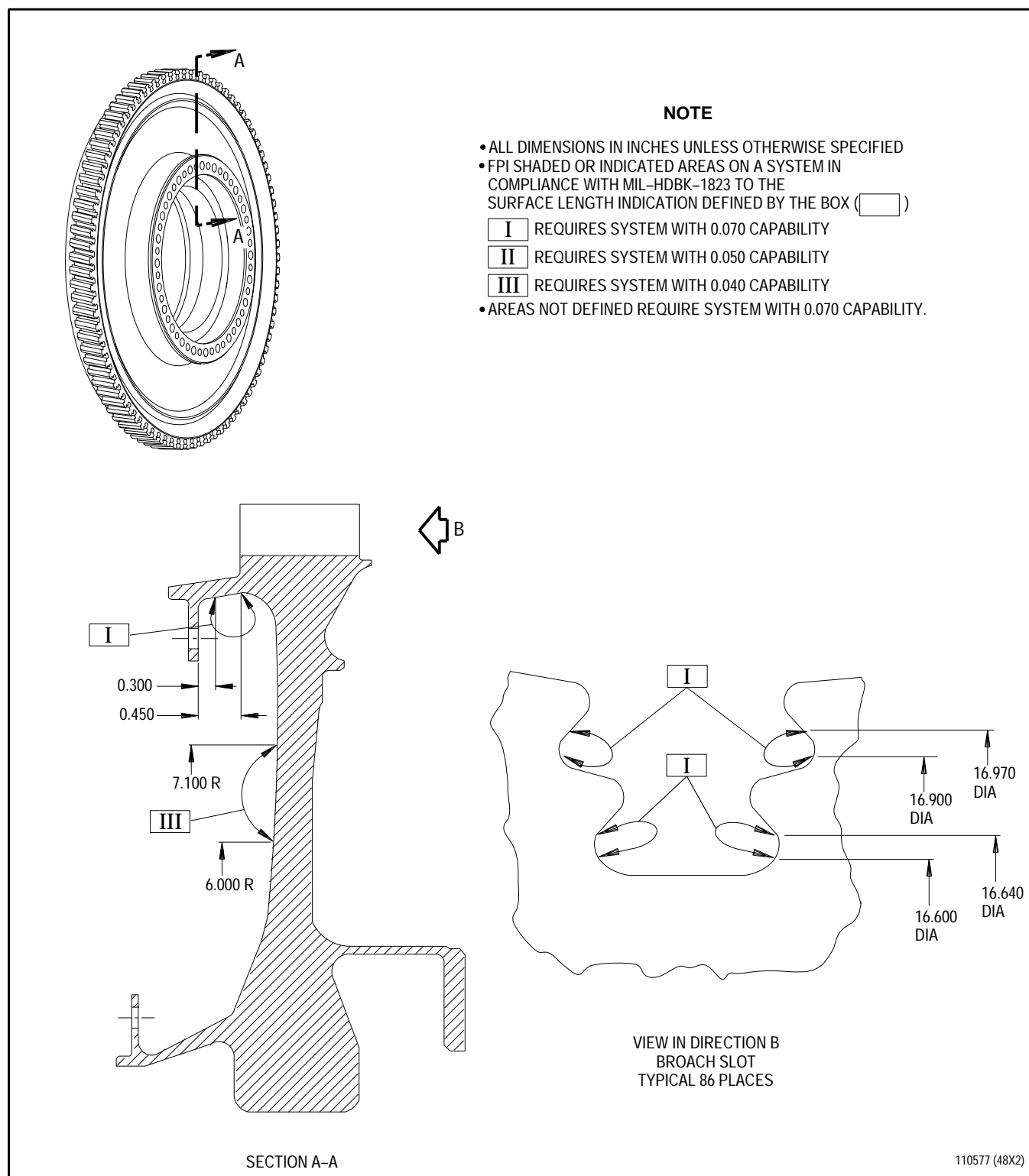


Figure 2. Third Stage Turbine Disk - Required Fluorescent Penetrant System Capability

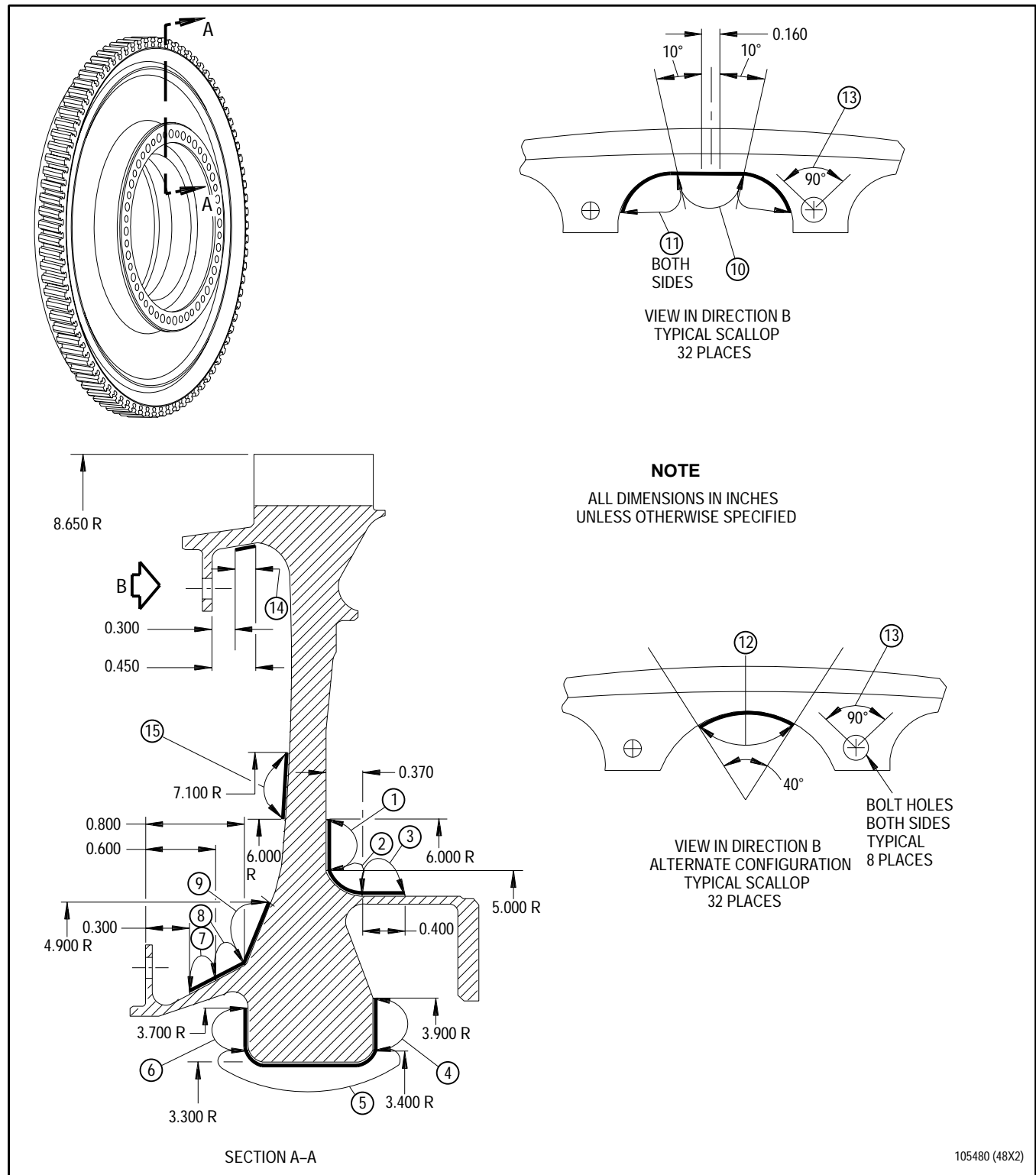


Figure 3. Third Stage Turbine Disk - Eddy Current Inspection

Legend for figure 3

Inspection Area	*Maximum Flaw Depth (Inch)	Flaw Surface Orientation	ECIS System Rejection Limits		Corrective Action
			Threshold (Counts)	(a ₅₀ -inch)	
1. Disk aft web	0.015	Radial	3797	0.0139	Replace disk
2. Disk aft flange outer radius	0.015	Axial, Radial	3797	0.0139	Replace disk
3. Disk aft flange O.D.	0.015	Axial	3797	0.0139	Replace disk
4. Disk aft bore face	0.018	Radial	4446	0.0149	Replace disk
5. Disk bore ID	0.018	Axial	4446	0.0149	Replace disk
6. Disk forward bore face	0.018	Radial	5022	0.0145	Replace disk
7. Disk forward flange face (inner)	0.025	Radial	5022	0.0145	Replace disk
8. Disk forward flange face (middle)	0.016	Radial	4385	0.0148	Replace disk
9. Disk forward flange face (outer)	0.025	Radial	4446	0.0149	Replace disk
10. Disk flat scallop (bottom)	0.017	Axial	3514	0.0136	Replace disk
11. Disk flat scallop (radius)	0.017	Axial	3514	0.0136	Replace disk
12. Disk scallop round (PN 4084103 only)	0.017	Axial	3514	0.0136	Replace disk
13. Disk bolthole balance weight tang	0.017	Axial	197	0.0129	Replace disk
14. Disk forward face flange I.D.	0.025	Circumferential	3093	0.0147	Replace disk
15. Disk forward web	0.025	Radial Circumferential	3093	0.0147	Replace disk

*Eddy current inspect on system in compliance with MIL-HDBK-1823.

3. THIRD STAGE TURBINE DISK (PN 4080603 AND 4084103) - SNAP DIAMETER MEASUREMENT.

(See Tables 1 and 2.)

- a. Measure third stage turbine disk front snap diameters as follows:

- (1) Place PWA 57866 3rd stage turbine disk constraining fixture on cordax or surface plate. Secure, if required. Install disk assembly as follows:

- (a) Remove clamp plate assembly and swing C-washer assembly from center stud.
- (b) Swing C-washers (four places) and rotate clamps out of position so disk assembly can be placed into fixture.
- (c) Wipe inner and outer locating ring surfaces clean. Visually check for imperfections.
- (d) Install 3rd stage turbine disk, rear side down, onto fixture so disk rests on locating rings.
- (e) Swing clamps into position on disk assembly. Install clamp plate over center stud.



Failure to properly torque nuts may damage disk.

- (f) Install clamp plate swing C-washer assembly. Install clamp plate nut on center stud, torque 400 to 450 pound-inches.
- (g) Install swing C-washer assemblies over clamps (four). Install nuts and torque 300 to 350 pound-inches.

- (2) Measure 3rd stage turbine disk front inner and outer snap diameters as follows:



Failure to handle precision instruments with care may result in damage.

- (a) Place PWA 57867 master on a steady, flat surface.

NOTE

Two snap diameter gages exist. Use PWA 57868 gage to measure 3rd stage turbine disk front inner snap diameter. Use PWA 57869 gage to measure 3rd stage turbine disk front outer snap diameter

- (b) Install appropriate gage on PWA 57867 master, carefully contacting gage indicator foot to gage flat on master.
- (c) Connect thermocouple lead from gage to SAALC 8041732 pyrometer.

NOTE

Pyrometer operates from either 100 to 125 vac or 190 to 250 vac, 48 to 400 hz power source. Operating instructions appear in pyrometer manual.

- (d) Connect pyrometer to appropriate power source.
- (e) Attach lead from electronic gage head to SAALC 8041733 digital display unit. Follow operating instructions in display unit manual.
- (f) Connect digital display unit to power source.
- (g) Set digital unit zero adjusting knob to 5.

- (h) Press carbide tipped end of gage flat against master gaging flat. Swing gage head right, then left until lowest reading possible appears on digital display unit. Digital unit readout should be ± 0.0008 inch maximum.
- (i) When reading is more than ± 0.0008 inch, loosen screws holding gage head. Adjust gage head position by contacting appropriate gaging flats of master until a reading of ± 0.0008 inch maximum appears on digital display unit. Tighten gage head screws.
- (j) Recheck display unit reading to ensure that acceptable reading is maintained.
- (k) Maintaining acceptable reading with gage set on master, adjust dial on display unit to show all zeros prior to measuring disk diameter.
- (m) Carefully remove electrically connected gage from master and install on disk, locating on diameter to be measured.
- (n) Grip gage on insulated crossbar and swing contacting gage indicator foot to right, then left slightly. Record reading shown on digital display unit. Take a minimum of two readings at equally spaced locations. Average the readings and record as minimum dimensional variance.
- (o) Record temperature of disk as indicated by pyrometer.
- (p) Determine actual disk diameter by following steps outlined in tables 1 and 2.

NOTE

- Space is provided in Table 1 to record specific information.
- Dimension etched on brass tag of master is diameter in a controlled 68°F (20°C) environment and shall be used to determined actual disk diameter.

- (1) Record temperature of master as indicated by pyrometer.

Table 1. Computing Actual Disk Diameter

Step	Description	Dimension or Temperature
1	Dimension etched on master	
2	Temperature of master	
3	Master temperature variance (step 2 minus 68°F (20°C))(+/-)	
4	Master dimension correction (see table 2)(+/-)	
5	Master dimension* (step 1 ± step 4)	
6	Minimum dimensional variance	
7	Disk dimension** (step 5 ± step 6)	
8	Temperature of disk	
9	Disk temperature variance (step 8 minus 68°F (20°C))	
10	Disk dimension correction (see table 2)(+/-)	
11	Actual disk diameter at 68°F (20°C)*** (step 7 ± step 10)	

* If the temperature of the master is lower than 68°F (20°C), subtract dimension correction.

** If the minimum dimensional variance is in the positive range, add variance.
If the minimum dimensional variance is in the negative range, subtract variance.

*** If the temperature of the disk is higher than 68°F (20°C), subtract dimension correction. If the temperature of the disk is lower than 68°F (20°C), add dimension correction.

Table 2. Third Stage Turbine Disk - Temperature Dimension Correction

Disk Diameter Inches	Combined Temperature Variance														
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
6-8	.00005	.00010	.00015	.00020	.00025	.00030	.00035	.00045	.00050	.00055	.00060	.00065	.00070	.00075	.00080
8-10	.00005	.00015	.00020	.00025	.00035	.00040	.00050	.00055	.00060	.00070	.00075	.00080	.00090	.00095	.00105
10-12	.00010	.00015	.00025	.00035	.00040	.00050	.00060	.00065	.00075	.00085	.00090	.00100	.00110	.00115	.00125
14-16	.00010	.00025	.00035	.00045	.00055	.00070	.00080	.00090	.00105	.00115	.00125	.00135	.00150	.00160	.00170
16-18	.00015	.00025	.00040	.00050	.00065	.00080	.00090	.00105	.00115	.00130	.00140	.00155	.00170	.00180	.00195
Disk Material is PWA 1106															

- b. Measure 3rd stage turbine disk rear inner and outer snap diameters as follows:

- (1) Place PWA 57870 rear 3rd stage turbine disk constraining fixture on cordax or surface plate. Secure if required. Install disk assembly in fixture as follows:
 - (a) Remove center clamp plate, swing C-washer assembly and related parts from center stud.
 - (b) Swing C-washers (four) and rotate clamps out of position so that disk assembly can be placed into fixture.
 - (c) Wipe inner and outer locating ring surfaces clean. Visually check for imperfections.
 - (d) Place disk assembly, hub flange up, into fixture so disk rests on locating rings.
 - (e) Swing clamps into position on disk assembly. Install clamp plate over center stud.



Failure to properly torque nuts will damage disk.

- (f) Install clamp plate swing C-washer assembly. Install clamp plate nut on center stud, torque 400 to 450 pound-inches.
- (g) Install swing C-washer assemblies over clamps (four). Install nuts and torque 300 to 350 pound-inches.



Failure to handle precision instruments with care may result in damage.

- (2) Place PWA 57871 master on a sturdy, flat surface.

NOTE

Two snap diameter gages exist. Use PWA 57872 gage to measure 3rd stage turbine disk rear inner snap diameter. Use PWA 57873 gage to measure 3rd stage turbine disk rear outer snap diameter

- (3) Install appropriate gage on PWA 57871 master, carefully contacting gage indicator foot to gage flat on master.
- (4) Measure diameters per steps a.(2)(c) through a.(2)(p).

4. THIRD STAGE TURBINE DISK - STRETCH MEASUREMENT INSPECTION.

(See figure 1.)

- a. Measure Diameter R on disk(6, figure 1) for stretch measurement as follows:
 - (1) Measure snap diameter in four places equally spaced per paragraph 3, step b.
 - (2) Compute average diameter.
 - (3) Compare average diameter to that recorded on applicable AFTO Form 44, or marked on disk at OD end of fir trees.
 - (4) Replace disk if average computed diameter exceeds AFTO Form 44 (indicated stretch) or diameter marked on disk by more than 0.004 inch.

WORK PACKAGE**TECHNICAL PROCEDURES****BLADE, TURBINE ROTOR, THIRD STAGE -****INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 20

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	30	5	28	10A Added	30
2	15	6	0	10B Blank Added	30
3	28	7 - 8	28	11 - 12	15
4	30	9	0	13 - 15 Added	15
4A Added	30	10	30	16 Blank Added	15
4B Blank Added	30				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

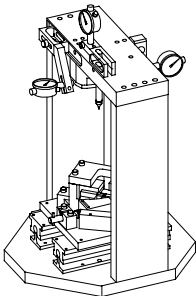
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
3	Third Stage Turbine Blades - Stretch, Twist and Cross-notch Wear Inspection	
	Set, Checking - third stage turbine blade - - - -	PWA 57789

ILLUSTRATED SUPPORT EQUIPMENT



PWA 57789 -C

Figure T1. PWA 57789 Checking Set

1. INTRODUCTION.

- a. This work package contains instructions for inspection of 3rd stage turbine rotor blades.

2. THIRD STAGE TURBINE ROTOR BLADES - INSPECTION.

(See Figures 1 through 3.)



Failure to replace front compressor drive turbine and stator assembly that has undergone an overspeed may result in engine failure.

NOTE

Any low turbine having exceeded 12,400 rpm for 1/2 second or more is considered to have undergone an overspeed.

- a. Replace front compressor drive turbine rotor and stator assembly considered to have undergone an overspeed.

NOTE

No cleaning or inspection required on third stage turbine rotor blades PN 4075403 with 4300 cycles or more.

- b. Ensure 3rd stage turbine rotor blades have been cleaned per WP 201 00.
- c. Visually inspect 3rd stage turbine blades. (See figure 1.)
- d. Fluorescent penetrant inspect 3rd stage turbine rotor blades for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.

- e. Inspect 3rd stage turbine blades for stretch, twist and cross-notch wear per paragraph 3.
- f. Perform inspections if 3rd stage blade is liberated or partially missing and turbine distress was accompanied by (excessive) vibration as reported by pilot or operator, refer to T.O. 2J-F100-53-2, WP 037 00, Table 1.

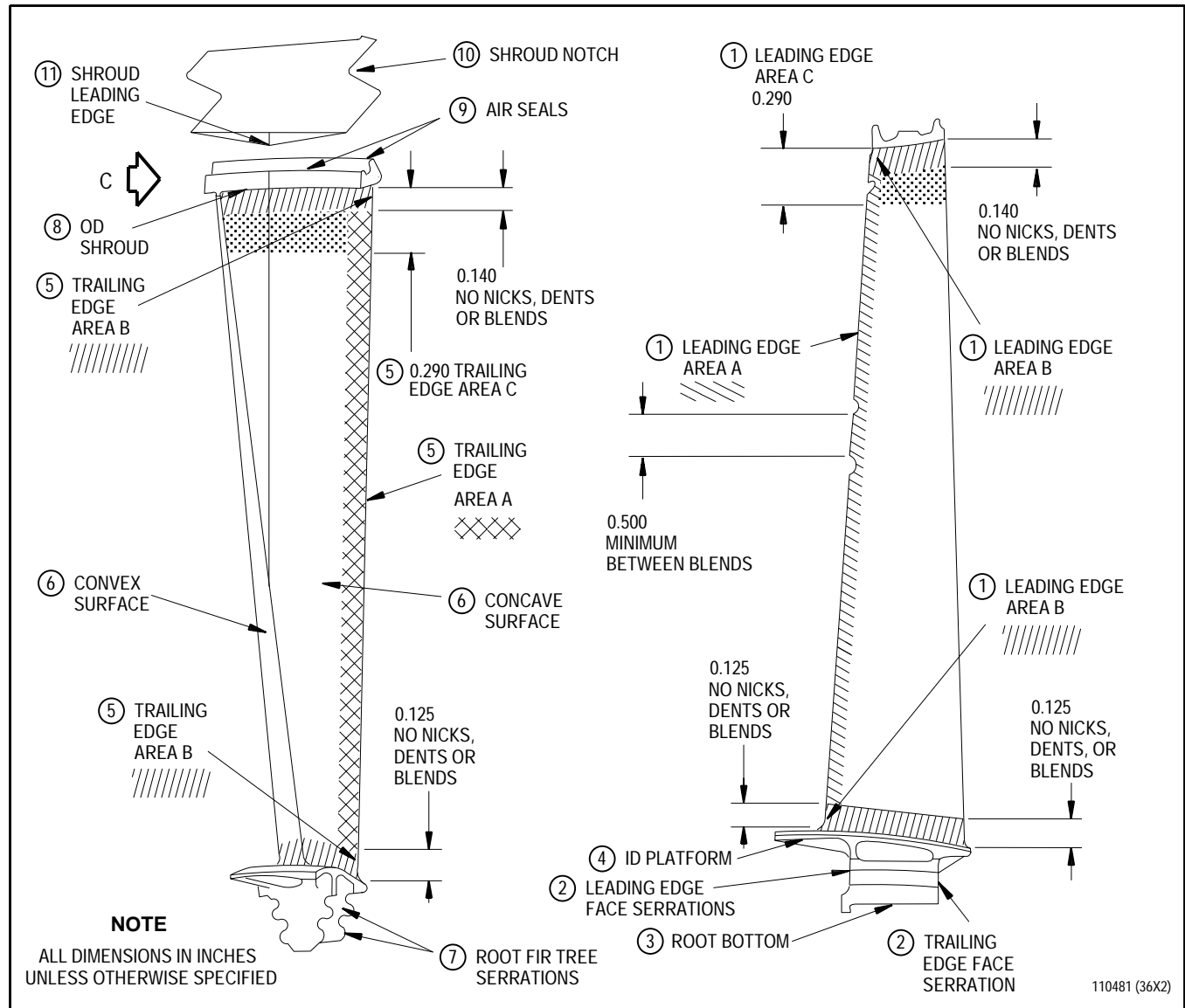


Figure 1. Third Stage Turbine Rotor Blades - Inspection (Sheet 1 of 2)

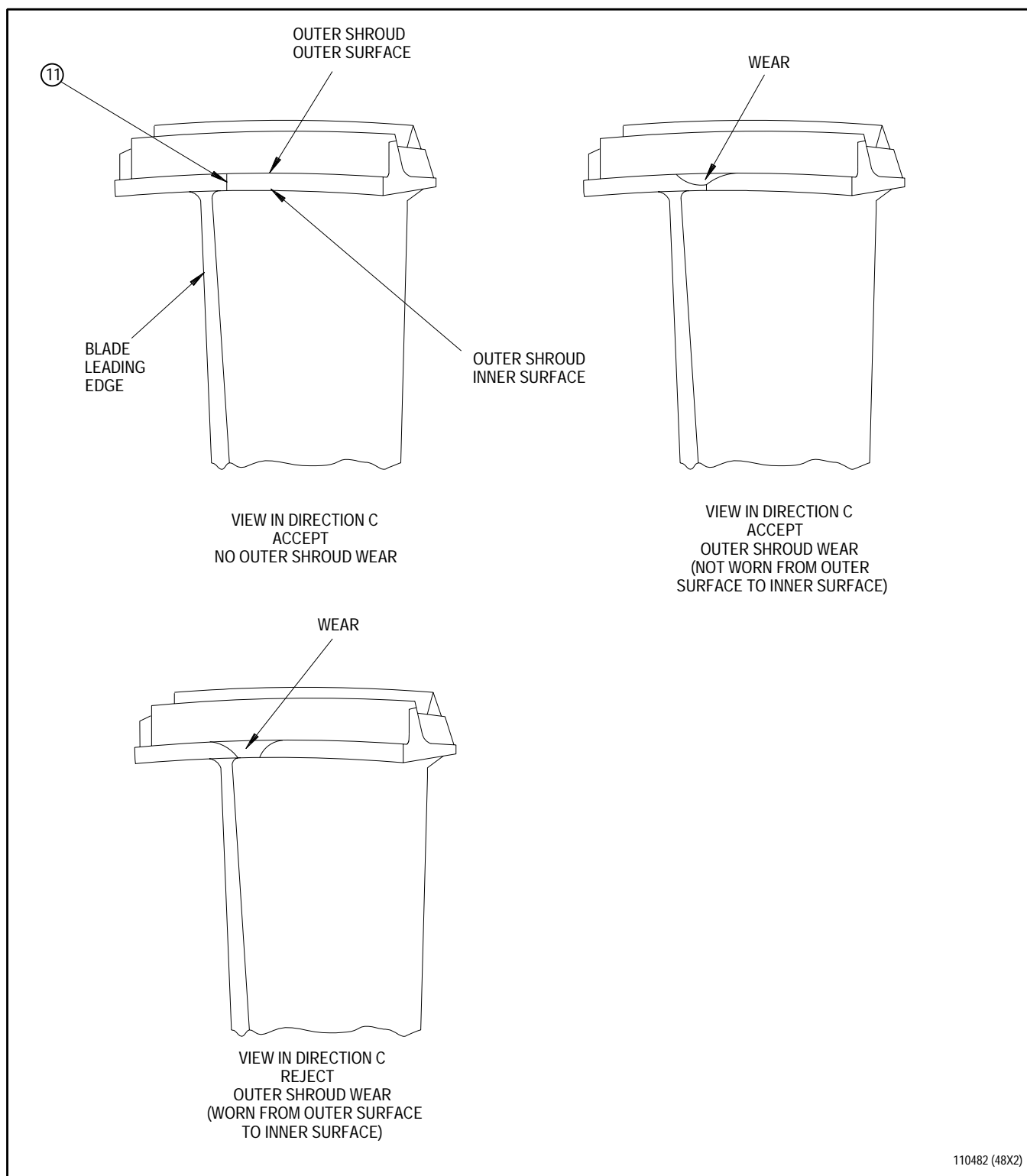


Figure 1. Third Stage Turbine Rotor Blades - Inspection (Sheet 2 of 2)

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Leading edge -			
• Area A			
Nicks and dents	Up to 0.030 inch deep and 0.300 inch diameter provided each is separated by 0.500 inch. No sharp edges permitted.	Three blends up to 0.035 inch deep provided blends are not within 0.500 inch of each other.	Blend repair per WP 413 00.
Cracks		Three blends up to 0.035 inch deep provided blends are not within 0.500 inch of each other.	Blend repair per WP 413 00.
• Area B			
Nicks, dents, blends, and cracks	Not serviceable	Not repairable	Replace blade.
• Areas A and B			
Foreign material splatter	Serviceable	See corrective action	Grit blast per WP 413 00. If splatter cannot be removed by grit blast, blend within limits for nicks and dents.
• Area C			
Marks, nicks	No blending permitted. No sharp edges and no raised material permitted when viewed using 10X magnification.	Not repairable	Replace blade.
Dents, cracks	Not serviceable	Not repairable	Replace blade.
Erosion (PN 4075403)	Not serviceable	Not repairable	Replace blade.
Missing coating (PN 4081603)	Not serviceable	Not repairable	Replace blade.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
2. Leading and trailing edge face serrations -			
Nicks, dents, pits and wear	Up to 0.005 inch deep. Maximum diameter of nicks, dents is 0.062 inch in up to two locations per face.	See corrective action	Blend repair. Per WP 413 00.
Cracks	Not serviceable	Not repairable	Replace blade.
3. Root bottom -			
Nicks, dents, pits, and wear	Up to 0.005 inch deep. Maximum diameter of nicks and dents is 0.015 inch.	See corrective action	Blend repair. Per WP 413 00.
Cracks	Not serviceable	Not repairable	Replace blade.
4. ID platform -			
Nicks, dents, pits	Up to 0.015 inch deep and 0.062 inch maximum diameter in up to six locations. If within airfoil/ platform radii no more than 0.005 inch deep and 0.031 inch maximum dimension.	Up to 0.020 inch deep and 0.100 inch maximum diameter in up to six locations.	Blend repair. Per WP 413 00.
Cracks	Not serviceable	Up to 0.020 inch deep and 0.100 inch maximum diameter in up to six locations.	Blend repair. Per WP 413 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
5. Trailing edge -			
• Area A			
Nicks and dents	Up to 0.030 inch deep and 0.300 inch in diameter provided each is separated by 0.500 inch. No sharp edges permitted.	Three blends up to 0.035 inch deep provided blends are not within 0.500 inch of each other.	Blend repair. Per WP 413 00.
Cracks	Cracks detected through nondestructive or visual inspection are not allowed.	Not repairable	Replace blade.
• Area B			
Nicks, dents, blends, and cracks	Not serviceable	Not repairable	Replace blade.
• Areas A and B			
Foreign material splatter	Serviceable	See corrective action	Grit blast. Per WP 413 00. If splatter cannot be removed by grit blast, blend within limits for nicks and dents.
• Area C			
Marks, nicks	No blending permitted. No sharp edges and no raised material when viewed using 10X magnification.	Not repairable	Replace blade.
Dents, cracks	Not serviceable	Not repairable	Replace blade.
Erosion (PN 4075403)	Not serviceable	Not repairable	Replace blade.
Missing coating (PN 4081603)	Not serviceable	Not repairable	Replace blade.

Legend for figure 1 (continued)

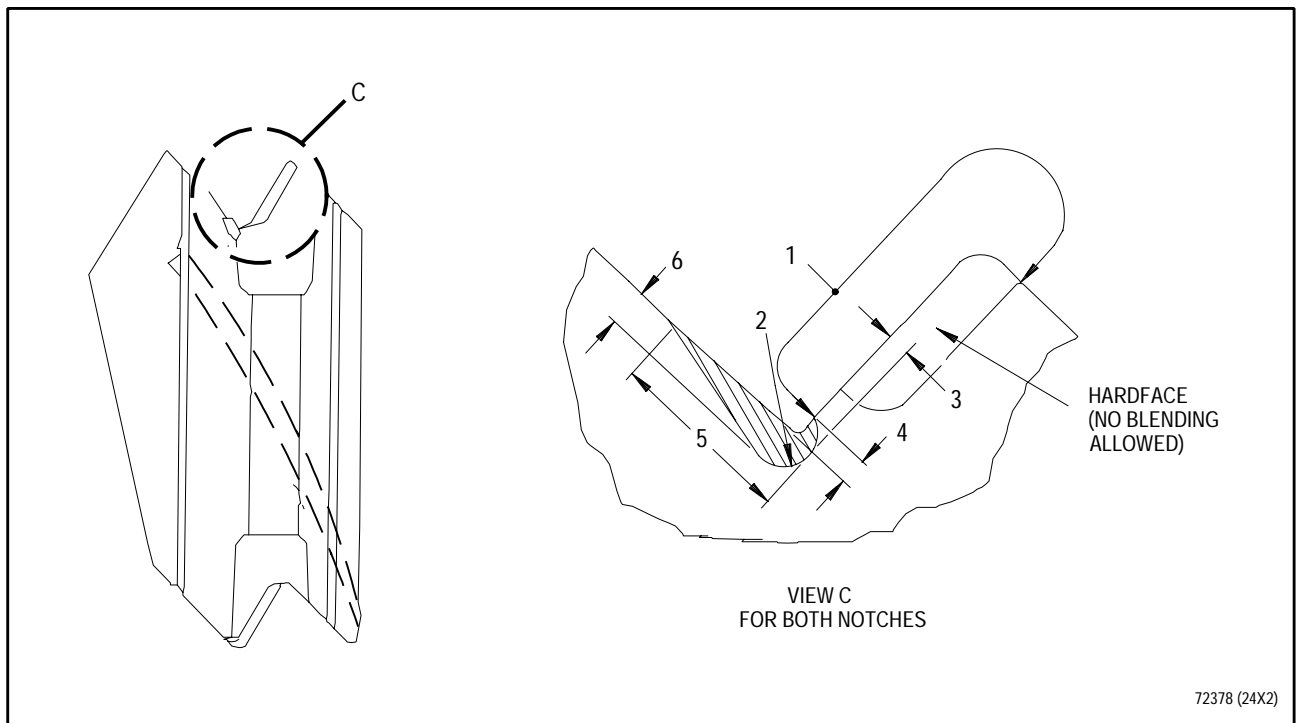
Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
6. Concave and convex surfaces -			
Foreign material splatter	Serviceable	See corrective action	Grit blast. Per WP 413 00.
Dents which are detectable on opposite side	Not serviceable	Not reparable	Replace blade.
Dents visible on only one side	Three dents per blade are acceptable provided dents do not overlap each other.	Not reparable	Replace blade.
Cracks	Not serviceable	Not reparable	Replace blade.
Erosion (PN 4075403)	Not serviceable	Not reparable	Replace blade.
Missing coating (PN 4081603)	Not serviceable	Not reparable	Replace blade.
7. Root fir tree serrations -			
Nicks, dents, pits and wear	Up to 0.002 inch deep. Maximum diameter of nicks, dents is 0.015 inch.	Not reparable	Do not attempt to repair. Replace blade.
Cracks	Not serviceable	Not reparable	Replace blade.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
8. OD shroud (except knife-edge seals) -			
Nicks and dents	Smooth dents are acceptable up to depth of 0.010 inch. No sharp edges permitted. Indications in airfoil/shroud radii shall be no deeper than 0.002 inch.	Maximum depth of blend shall not exceed 0.015 inch.	Blend repair. Refer to WP 413 00.
Blade stretch		Not repairable	Replace blade.
9. Air seals -			
Cracks, nicks, and dents	Not serviceable	See figure 3.	Blend repair. Refer to WP 413 00.
Wear	Refer to WP 801 00, Reference 4401.	Not repairable	Replace blade.
Bent	Serviceable	Not repairable	Do not attempt to straighten.
Bent or damaged knife-edge seal corners	Not serviceable	a. Bent or damaged seal corners shall be blended to 0.100 inch radius. b. Blends on two opposite corners permitted per blade.	Blend repair. Refer to WP 413 00.

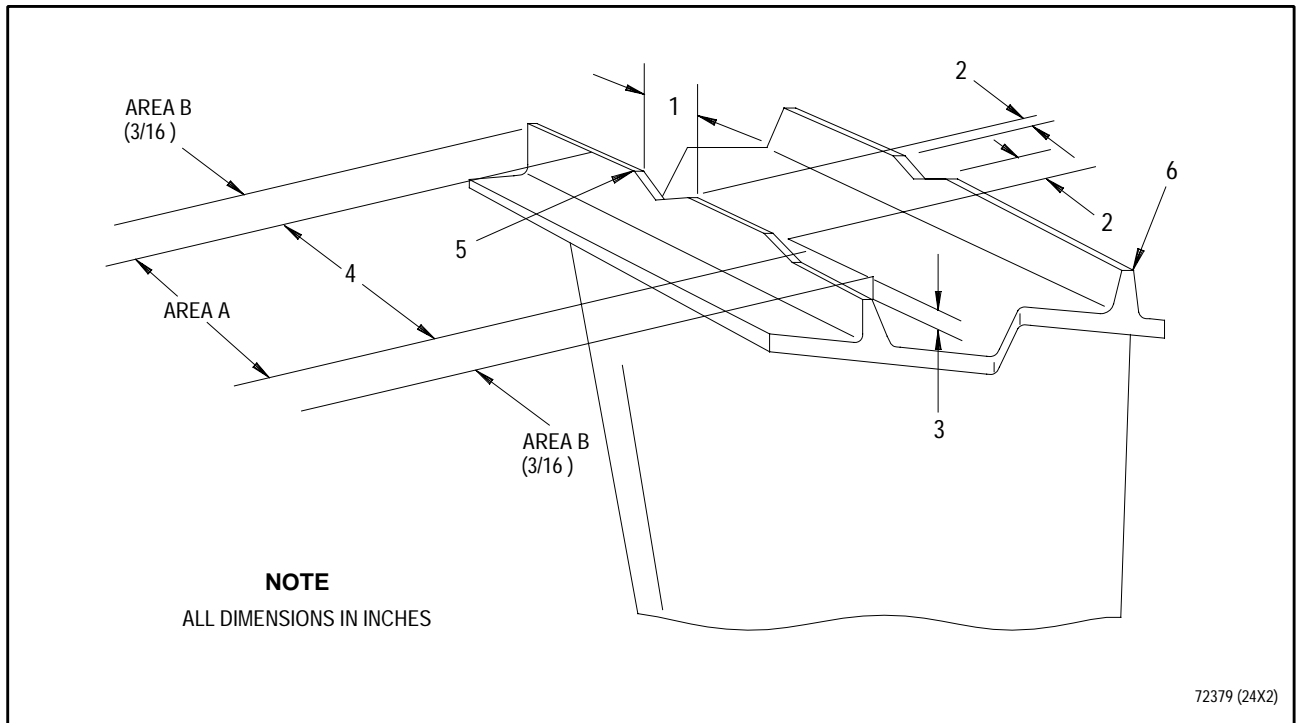
Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
10.Shroud notch area -			
Cracks	Not serviceable	See figure 2.	Blend repair per WP 413 00.
Point-to-point contact, upset or displaced material, uneven wear pattern	Not serviceable	See figure 2.	Blend repair per WP 413 00.
11.Shroud leading edge -			
Wear	See figure 1. sheet 2 of 2.	Not reparable	Replace blade.



1. No blending allowed
2. 0.025 to 0.035 inch radius
3. 0.012 inch maximum
4. 0.035 to 0.045 inch minimum undercut radius runout
5. 0.150 inch maximum
6. 0.020 inch maximum

Figure 2. Third Stage Turbine Rotor Blades - Shroud Notch Blend Repair Limits



1. 0.250 inch maximum blend width within Area A
2. Blend repairs on adjacent knife-edge seals shall not align axially.
3. Maximum depth shall not exceed 0.045 inch.
4. Blend repair which is located partly between Areas A and B shall require remaining knife-edge seal in Area B to be removed. Only one such repair per blade is allowed.
5. All blends shall have 1/8 inch radius on both ends of repair, with exception of blend repair in 4.
6. Corners which are bent or damaged may be blended to 0.100 inch radius. Blends on two opposite corners are allowed per blade.

Figure 3. Third Stage Turbine Rotor Blades - Knife-Edge Seals Blend Repair Limits

**3. THIRD STAGE TURBINE ROTOR BLADES -
STRETCH, TWIST AND CROSS-NOTCH WEAR
INSPECTION.**

(See Figure 4.)

a. Prepare PWA 57789 checking set as follows:

- (1) Retract all indicator pins and lock in position.
- (2) Position all dial indicators(1, 2, and 10, figure 4) so stems rest on fixture blocks and read zero.
- (3) Push detail-42 wedge(3) aft and lock in position to prevent rotation of detail-12 root holder(7).
- (4) Slide detail-47 block(9) aft and lock in position using thumbscrew.

b. Record production height of 3rd stage turbine rotor blade as marked on bottom of blade root.

c. Insert blade root into detail-12 root holder(7) until blade root tang bottoms out against root holder base. Turn root holder thumbscrew counterclockwise until blade root is locked in position.

d. Measure blade stretch as follows:

NOTE

Detail-22 dial indicator(2) is used to position turbine blade properly in fixture for measurements.

- (1) Ensure detail-22 dial indicator reads zero with indicator stem resting on fixture surface. Adjust if necessary.

(2) Swing detail-22 dial indicator downward until fixture stop is reached and dial indicator stem is centered over indicator pin.

(3) Turn micrometer thumbscrew(4) clockwise to move detail-2 base(6) aft until detail-22 dial indicator reads zero.

(4) Slowly rotate lever of detail-6 indicator pin(8) to slot in fixture and carefully lower pin onto Point BX on blade tip shroud.

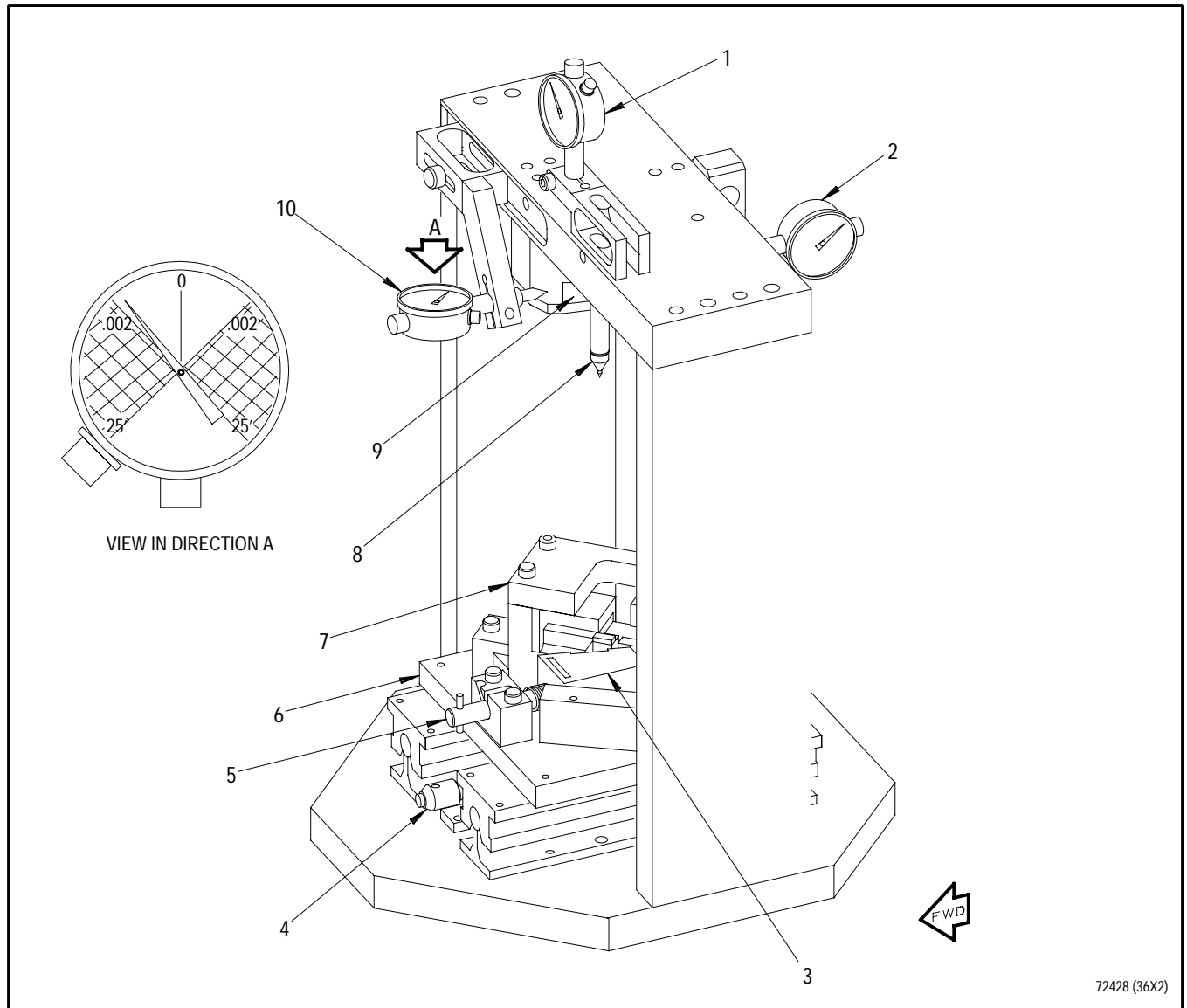
(5) Ensure detail-25 dial indicator(1) reads zero with indicator stem resting on fixture surface. Adjust if necessary.

(6) Slide detail-25 dial indicator left until fixture stop is reached and indicator stem is centered over detail-6 indicator pin(8).

(7) Record measurement from detail-25 dial indicator.

(8) Slide detail-25 dial indicator to right until fixture stop is reached. Using lever of detail-6 indicator pin(8), carefully lift pin from blade and rotate lever to stored position.

(9) Calculate blade stretch and record difference. Reject blade if stretch exceeds 0.015 inch.



72428 (36X2)

1. Detail-25 dial indicator
2. Detail-22 dial indicator
3. Detail-42 wedge
4. Micrometer thumbscrew
5. Detail-45 rod
6. Detail-2 base
7. Detail-12 root holder
8. Detail-6 indicator pin
9. Detail-47 block
10. Detail-28 dial indicator

Figure 4. Third Stage Turbine Rotor Blades - Stretch, Twist and Cross-notch Wear Inspection

e. Measure blade twist as follows:

- (1) Slide detail-28 dial indicator(10) right until indicator stem point is at midpoint of cross-notch face of blade tip.
- (2) Turn micrometer thumbscrew(4) approximately 3/4 turn counterclockwise to move detail-2 base(6) forward until detail-28 dial indicator needle points at line halfway between the 25' marks on indicator face.
- (3) Carefully slide detail-28 dial indicator right until indicator stem point barely touches adjacent cross-notch face. Do not force indicator point against face.
- (4) Adjust dial face of detail-28 dial indicator to place needle at line halfway between 25' marks on face.
- (5) Carefully slide detail-28 dial indicator left while observing position of indicator needle. Reject blade for twist over limits if needle movement exceeds 25'.

NOTE

Indicator needle will show over limit condition as indicator point runs off edge of blade.

- (6) Slide detail-28 dial indicator left until fixture stop is reached.
- (7) Turn micrometer thumbscrew(4) counterclockwise approximately four full turns to move detail-2 base(6) forward.

f. Measure blade tip cross-notch wear as follows:

- (1) Disengage detail-42 wedge(3) from detail-12 root holder(7) by pulling detail-45 rod(5) forward and rotating into locked position. This will allow root holder to rotate.
- (2) Unlock detail-47 block(9) by loosening thumbscrew.
- (3) Turn micrometer thumbscrew(4) clockwise to move detail-2 base(6) aft until blade tip shroud contacts two carbide tips of detail-47 block.
- (4) Rotate detail-12 root holder(7), if necessary, to ensure blade tip shroud surface contacts both tips of detail-47 block.
- (5) Turn micrometer thumbscrew(4) clockwise to move detail-2 base(6) aft until detail-22 dial indicator(2) reads zero.
- (6) Ensure detail-28 dial indicator(10) is at its far left position and reads zero with stem against fixture. Adjust if necessary.
- (7) Slide detail-28 dial indicator(10) right until indicator stem point is at midpoint of cross-notch face. Ensure detail-22 dial indicator(2) reads zero.
- (8) If detail-28 dial indicator(10) needle is in red area of dial (greater than 0.002 inch), blade is rejected and requires cross-notch repair.
- (9) Slide detail-28 dial indicator left until fixture stop is reached.

- g. Swing detail-22 dial indicator(2) upward until fixture stop is reached and lock in stored position.
- h. Turn micrometer thumbscrew(4) approximately four full turns counterclockwise to move detail-2 base forward.
- i. Turn detail-12 root holder thumbscrew clockwise until resistance is felt, then turn an additional 3/4 turn to unlock blade root.
- j. Carefully remove blade from fixture.

WORK PACKAGE**TECHNICAL PROCEDURES****BLADE, TURBINE ROTOR, FOURTH STAGE -****INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 18

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	2B Blank Added	23	13 - 14	21
2	21	3	28	15 Added	21
2A Added	23	4 - 12	0	16 Blank Added	21

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures	T.O. 2-1-111
Nondestructive Inspection	T.O. 2J-F100-9
Fan Drive Turbine Module	T.O. 2J-F100-53-9
Fan Drive Turbine Module - Table of Limits	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Cloth, abrasive crocus	P-C-458
Pencil (crayon), silver metal marking (hard)	Color brite No. 2101 or Color-tex No. 1843 or Anadel No. 1936

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
3	FOURTH STAGE TURBINE ROTOR BLADES SHROUD CROSS NOTCH AND STRETCH DIMENSIONS - INSPECTION FIXTURE, CHECKING, 4TH STAGE TURBINE BLADE LENGTH AND SHROUD NOTCH	PWA 57672
4	FOURTH STAGE TURBINE ROTOR BLADE (PN 4082504) - LENGTH AND HARDFACE TO HARDFACE MEASUREMENT FIXTURE, CHECKING, 4TH STAGE TURBINE BLADE	PWA 57855

ILLUSTRATED SUPPORT EQUIPMENT

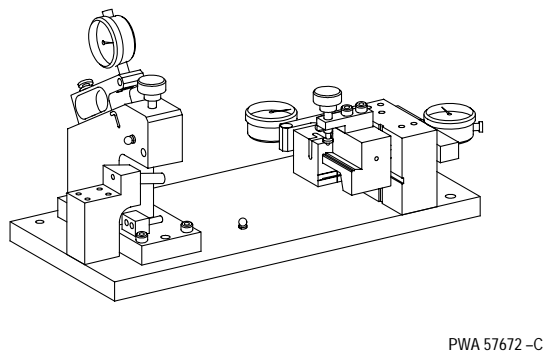


Figure T1. PWA 57672 FIXTURE

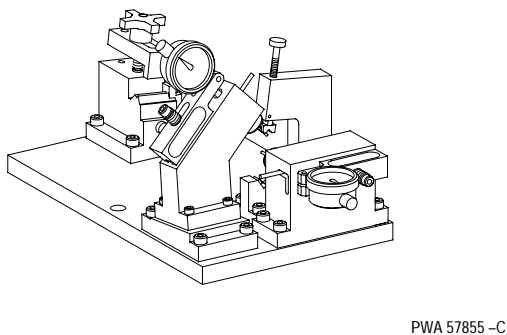


Figure T2. PWA 57855 FIXTURE

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 4th stage turbine rotor blades.

2. FOURTH STAGE TURBINE ROTOR BLADES - INSPECTION.

(See Figures 1 through 3.)

- a. Ensure 4th stage turbine rotor blades have been cleaned per WP 201 00.
- b. Visually inspect 4th stage turbine rotor blade. (See figure 1.)

- c. Fluorescent penetrant inspect 4th stage turbine rotor blades for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.
- d. Perform stretch measurement per paragraph 3.
- e. Perform inspections if 4th stage blade is liberated or partially missing and turbine distress was accompanied by (excessive) vibration as reported by pilot or operator, refer to T.O. 2J-F100-53-2, WP 037 00, Table 1.

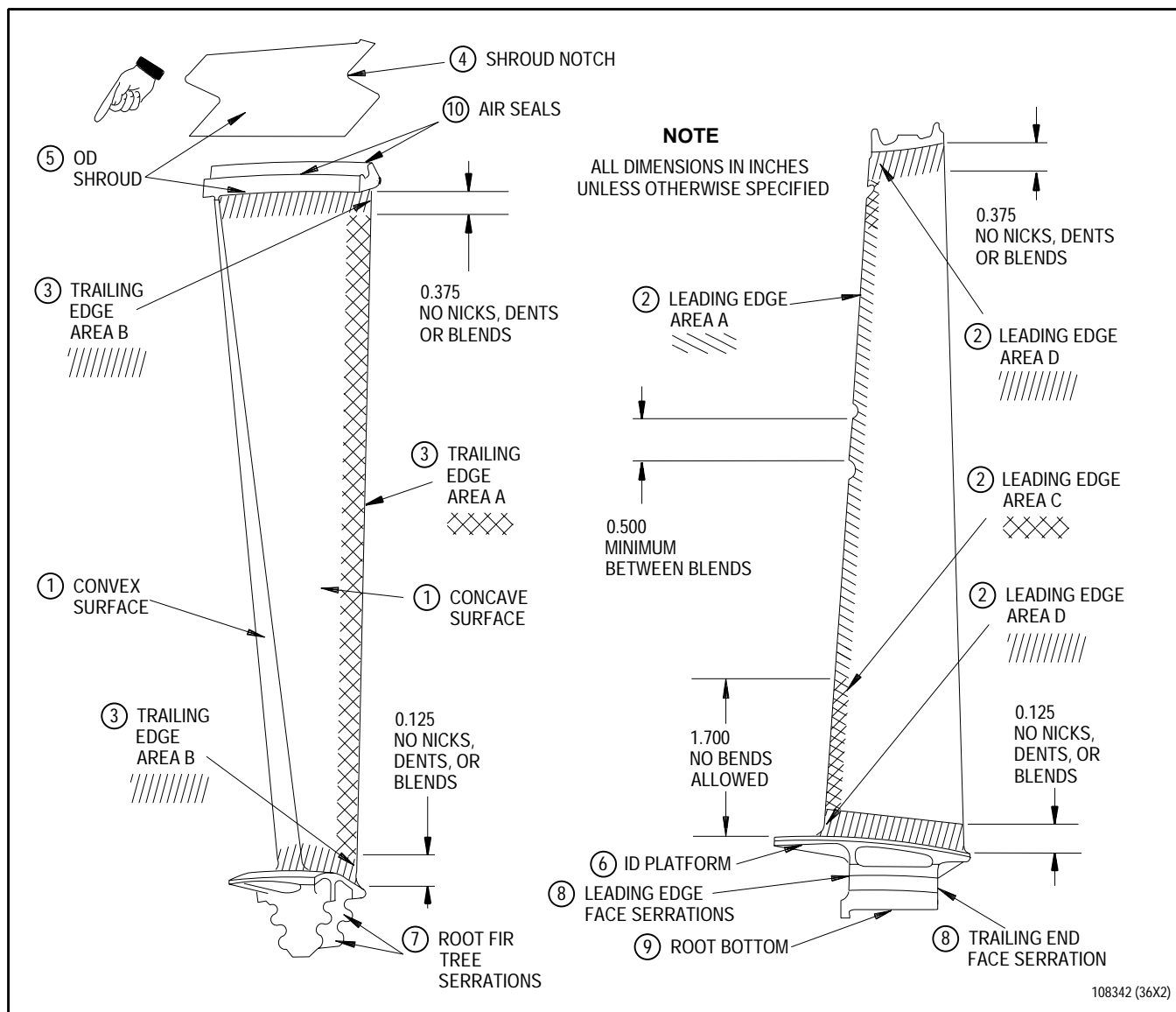


Figure 1. Fourth Stage Turbine Rotor Blades - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
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NOTE

Nondestructive inspect all blend areas. Refer to T.O. 2J-F100-9. No indications permitted.

1. Concave and convex
surfaces -

Foreign material splatter	Not serviceable	See corrective action.	Grit blast to remove splatter. Refer to T.O. 2J-F100-53-1 WP 040 00. If splatter over 0.005 inch cannot be removed, replace blade.
Dents which are detectable on opposite side	Not serviceable	Not repairable	Replace blade.
Dents visible on only one side	Three dents per blade are acceptable provided dents do not overlap each other.	Not repairable	Replace blade.
Cracks	Not serviceable	Not repairable	Replace blade.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
2. Leading edge -			
• Area A			
Nicks and dents	Up to 0.030 inch deep and 0.300 inch diameter provided each is separated by 0.500 inch. No sharp edges permitted.	Three blends up to 0.050 inch deep provided blends are not within 0.500 inch of each other.	Blend repair per WP 414 00.
Cracks	Cracks detected through nondestructive or visual inspection are not acceptable.	Not repairable	Replace blade.
• Area C			
Nicks, dents, blends, and cracks	Not serviceable	Not repairable	Replace blade.
Minor nicks less than 0.005 inch deep	Not serviceable	See corrective action	Blend repair per WP 414 00.
Cracks	No cracks permitted.	Not repairable	Replace blade.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
2. Leading edge - (continued)			
Area D			
Nick, dents, blends, and cracks	Not serviceable	Not repairable	Replace blade.
Areas A, C, and D			
Foreign material splatter	Not serviceable	See corrective action.	Grit blast to remove splatter. Refer to T.O. 2J-F100-53-1 WP 040 00. Splatter over 0.005 inch, which cannot be removed, shall be blended within limits specified for nicks and dents.
3. Trailing edge -			
• Area A			
Nicks and dents	Up to 0.030 inch deep and 0.300 inch in diameter provided each is separated by 0.500 inch. No sharp edges permitted.	Three blends up to 0.050 inch deep provided blends are not within 0.500 inch of each other.	Blend repair per WP 414 00.
Cracks	Not serviceable	Not repairable	Replace blade.
• Area B			
Nicks, dents, blends, and cracks	Not serviceable	Not repairable	Replace blade.
Cracks	Not serviceable	Not repairable	Replace blade.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
4. Shroud notch area -			
Cracks	Not serviceable	See Figure 2.	Blend repair per WP 414 00.
Point-to-point contact, upset or displaced material, uneven wear pattern	Not serviceable	See Figure 2.	Blend repair per WP 414 00.
5. OD shroud (except knife-edge seals) -			
Nicks and dents	Smooth dents are acceptable up to depth of 0.010 inch. No sharp edges permitted. Indications in airfoil/shroud radii shall be no deeper than 0.002 inch.	Maximum depth of blend shall not exceed 0.015 inch.	Blend repair per WP 414 00.
6. ID platform -			
Nicks, dents, pits	Up to 0.015 inch deep and 0.062 inch maximum diameter in up to six locations. If within airfoil/platform radii no more than 0.005 inch deep and 0.031 inch maximum dimension.	Up to 0.020 inch deep and 0.100 inch maximum diameter in up to six locations.	Blend repair per WP 414 00.
Cracks	Not serviceable	Not repairable	Replace blade.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
7. Root fir- tree serrations -			
Nicks, dents, pits and wear	Up to 0.002 inch deep. Maximum diameter of nicks, dents is 0.015 inch.	Not repairable	Do not attempt to repair. Replace blade.
Cracks	Not serviceable	Not repairable	Replace blade.
8. Root leading and trailing edge face serrations -			
Nicks, dents, pits and wear	Up to 0.005 inch deep. Maximum diameter of nicks, dents is 0.062 inch in up to two locations per face.	Not repairable	Do not attempt to repair. Replace blade.
Cracks	Not serviceable	Not repairable	Replace blade.
9. Root bottom -			
Nicks, dents, pits, and wear	Up to 0.005 inch deep. Maximum diameter of nicks and dents is 0.015 inch.	Not repairable	Do not attempt to repair. Replace blade.
Cracks	Not serviceable	Not repairable	Replace blade.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
10. Air seals -			
Cracks, nicks, and dents	Not serviceable	See Figure 3.	Blend repair. Refer to T.O. 2-1-111.
Wear (Knife edge)	Refer to T.O. 2J-F100-53-9, WP 801 00, Reference 4402	Not repairable	Replace blade.
Cutters	Any amount	None	Not applicable.
Bent	Serviceable (Do not attempt to straighten.)	None	Not applicable.
Bent or damaged knife-edge seal corners	Not serviceable	a. Bent or damaged seal corners may be blended to 0.100 inch radius. b. Blends on two opposite corners permitted per blade.	Blend repair per WP 414 00.

3. FOURTH STAGE TURBINE ROTOR BLADES SHROUD CROSS NOTCH AND STRETCH DIMENSIONS - INSPECTION.

a. Use PWA 57672 fixture to check 4th stage blade shroud cross notch and stretch dimensions.

b. Stretch maximum dimension is 6.804 to 6.834 inches.

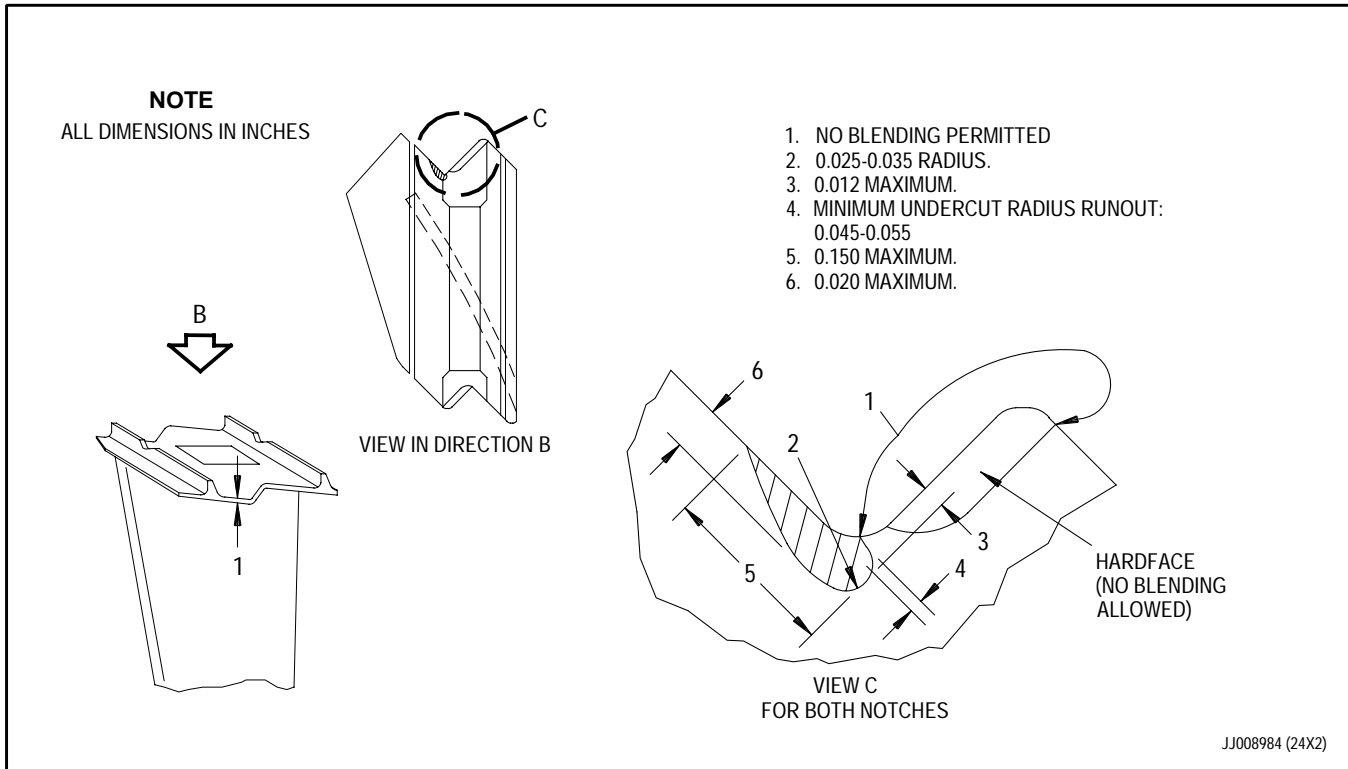


Figure 2. Fourth Stage Turbine Rotor Blade - Shroud Notch Blend Repair Limits

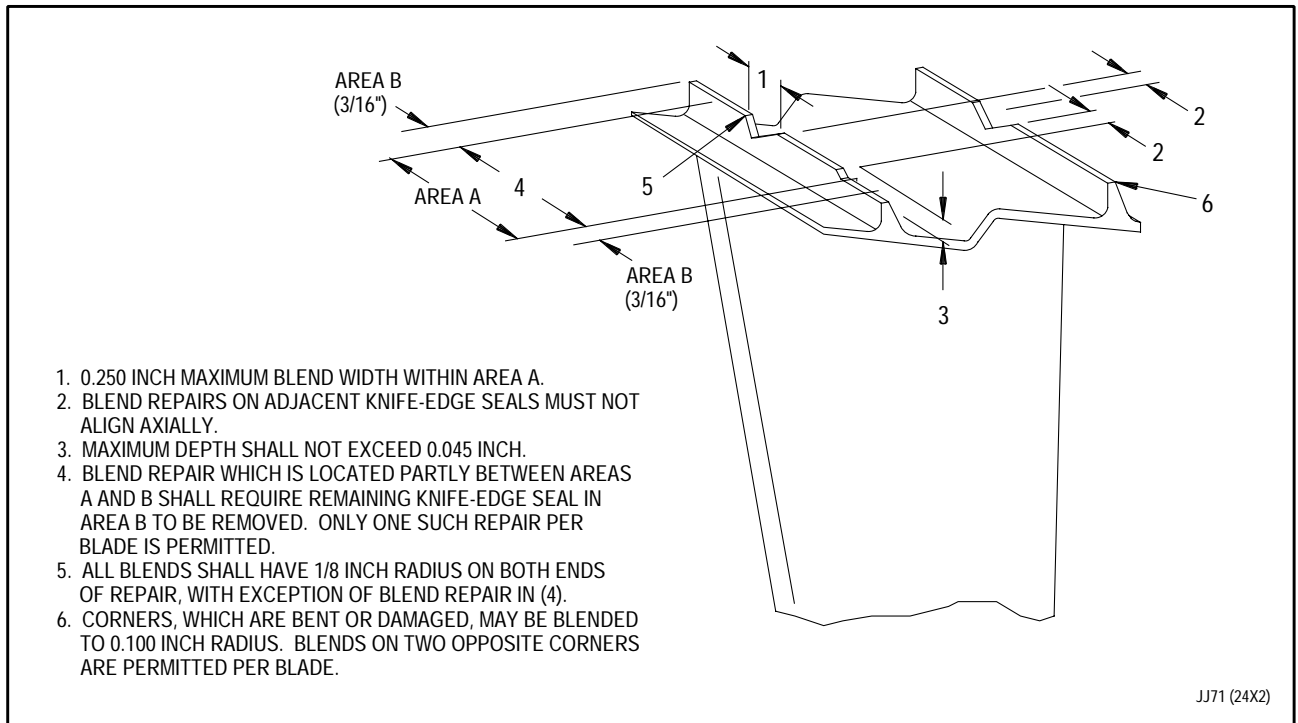
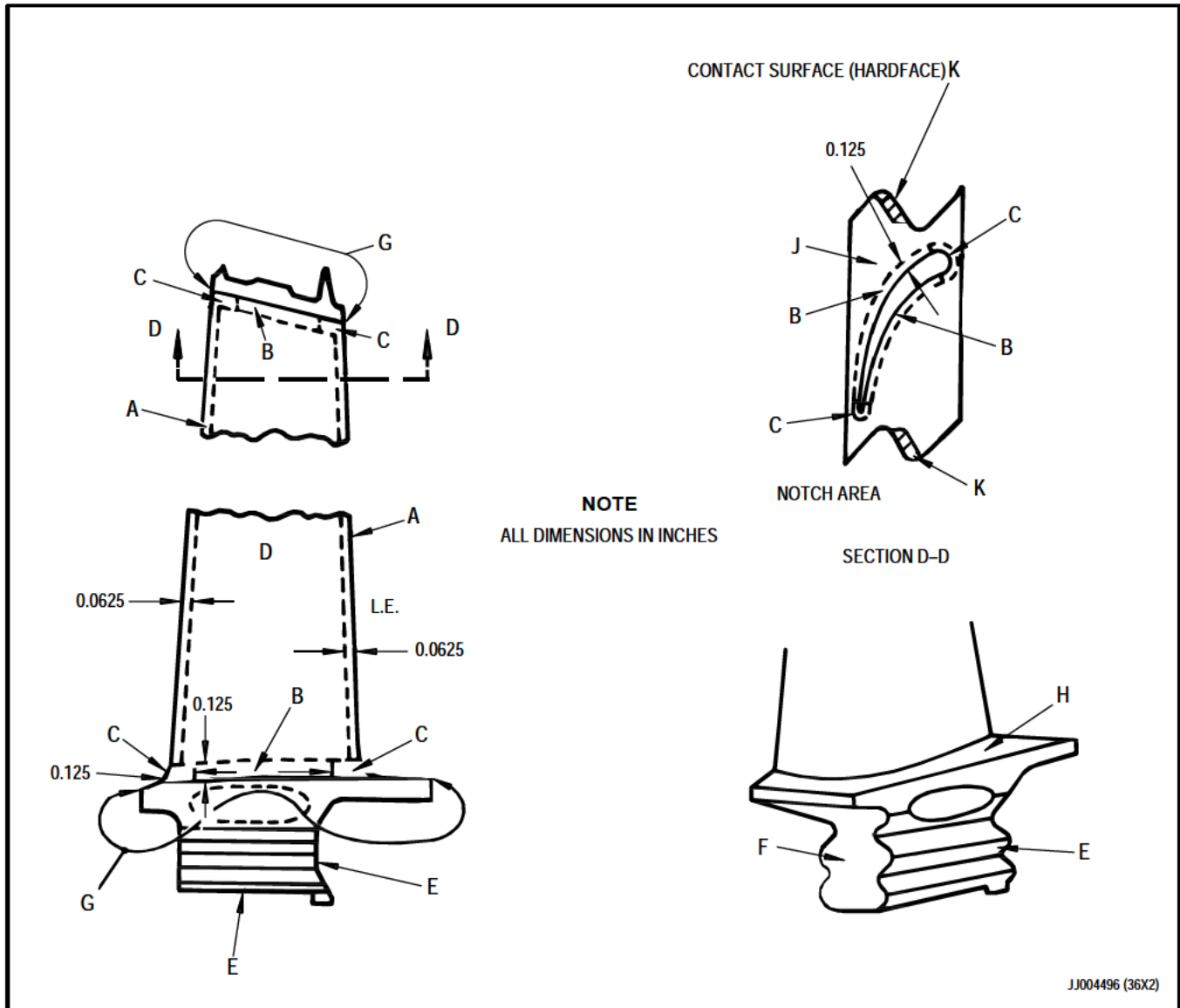


Figure 3. Fourth Stage Turbine Rotor Blade - Knife-Edge Seals Blend Repair Limits



Area	Maximum Quantity	Minimum Separation (Inch)	Maximum Diameter
A	12 per edge	1/8	1/32 inch
B	6 per side	1/8	1/64 inch
C	None		0.010 inch or more
D	12 per side	1/16	1/32 inch
E	None		0.010 inch or more
F	4 per side	1/8	1/32 inch
None permitted in area of serrations.			

Figure 4. Fourth Stage Turbine Rotor Blade - Fluorescent Penetrant Inspection

Legend for figure 2 (continued)

Area	Maximum Quantity	Minimum Separation (Inch)	Maximum Diameter
G and H	5 per inch of area length	1/16	1/32 inch
H	2 additional	1/4	1/8 inch
J	When hardfaced - unlimited cracks, lack of fusion or hot tears in weld metal or heat affected zone when not extending to or over an edge. 2 voids per surface in weld metal except no voids on face of contact surface or extending to or over edge.	1/16	3/32 inch 1/32 inch
K	None in notch radius		

NOTE

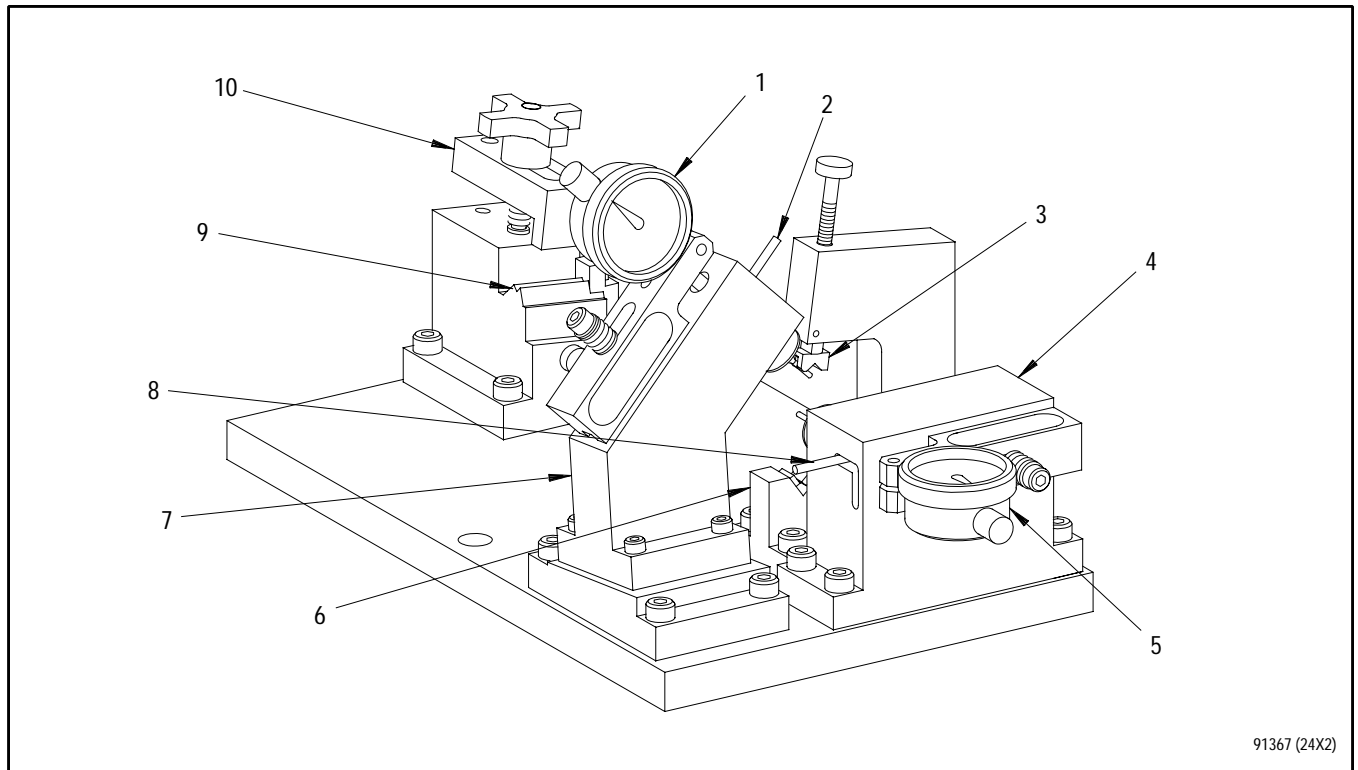
- Limits pertain only to indications of shrinkage and porosity (micro or macro) in areas specified. All other types of indications shall be disposed of per limits specified in figure 1. Circle suspect areas, using Colorbrite, No. 2101 or Color-Tex No. 1843 Silver crayon and note dimension and location of discrepancy on paper tag.
- All indications less than 0.010 inch which are not in linear alignment are acceptable at any location.

**4. FOURTH STAGE TURBINE ROTOR BLADE
(PN 4082504) - LENGTH AND HARDFACE TO
HARDFACE MEASUREMENT.**

(See Figure 5.)

- a. Prepare PWA 57855 fixture as follows:
 - (1) Rotate dial indicators(1 and 5) so stems contact set surfaces on blocks(4 and 7), adjust to read zero. This calibrates fixture to basic blade length and cross notch hardface to hardface dimensions.
 - (2) Retract and lock fixture gage pins(2 and 8) into storage positions.
 - (3) Retract clamps(3 and 10).

- b. Install blade into fixture as follows:
 - (1) Insert root end of blade into block clamp(9) while also placing blade outer platform into V-groove of block(6).
 - (2) Tighten clamp(10) then clamp(3) while holding blade in place.
- c. Release gage pins slowly untill pins contact blade surface.
- d. Position dial indicators so stems contact gage pins. Record readings.
- e. Retract dial indicators and lock gage pins into storage positons.
- f. Loosen clamps and remove blade from fixture.



- | | |
|-------------------|-------------|
| 1. Dial indicator | 6. Block |
| 2. Gage pin | 7. Block |
| 3. Clamp | 8. Gage pin |
| 4. Block | 9. Block |
| 5. Dial indicator | 10. Clamp |

Figure 5. Fourth Stage Turbine Rotor Blade (PN 4082504) - Length and Hardface-to-Hardface Measurement.

WORK PACKAGE

TECHNICAL PROCEDURES

FAN DRIVE TURBINE MODULE - SERVICE CYCLE MARKING

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 6					0

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedure - - - - -	T.O. 2-1-111

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for service cycle marking of applicable fan drive turbine module parts.

2. FAN DRIVE TURBINE MODULE - SERVICE CYCLE MARKING.

(See Figure 1 and Tables 1 and 2.)



When interchanging the following listed parts between modules, the parts must be transferred only to a module that has less total accumulated low cycle fatigue (LCF) cycles or (TAC) remaining before next scheduled depot visit.

- 3rd Stage Turbine Rotor Blades
- 4th Stage Turbine Rotor Blades

NOTE

- Service Cycle Marking of engine parts shall be accomplished immediately after parts are removed from engine/module. Parts shall not be removed from modules only for the purpose of service cycle marking.
 - Total accumulated cycles (TAC) are based on low cycle fatigue counts recorded by the EDU. Obtain the latest TAC count for the module from the engine management branch.
- a. Mark total accumulated cycles (TAC) on all required parts when parts are removed from engine/module. (See figure 1 and tables 1 and 2.)

- (1) Use controlled vibration peen marking method.

- (2) Do not exceed 0.006 inch in depth. Refer to T.O. 2-1-111.

- (3) Mark codes so they are legible.

- (4) Allocate space for maximum quantity of symbols to be marked in available space.


- (5) Marking shall not extend into radii, chamfers, sharp edges or fillets.

- (6) Use character size of 0.125 inch maximum.


- (7) Mark parts using codes in table 2 so that total accumulated cycles (TAC) are shown by last code marked on part.

Table 1. Cycle Coding Configuration Chart

Nomenclature	Marking Method	Location of Marking
3rd stage turbine rotor blades	Vibration-peen. Refer to T.O. 2-1-111.	Aft side of blade root. (See figure 1.)
4th stage turbine rotor blades	Vibration-peen. Refer to T.O. 2-1-111.	Aft side of blade root. (See figure 1.)

SYMBOL	CYCLES	SYMBOL	CYCLES	SYMBOL	CYCLES
	0 NEW	<u>B</u>	1200 – 1400	<u>C</u>	2800 – 3000
T	UNKNOWN	<u>B</u>	1400 – 1600	D	3000 – 3200
A	0–200	<u>B</u>	1600 – 1800	<u>D</u>	3200 – 3400
<u>A</u>	200 – 400	<u>B</u>	1800 – 2000	<u>D</u>	3400 – 3600
<u>A</u>	400 – 600	C	2000 – 2200	<u>D</u>	3600 – 3800
<u>A</u>	600 – 800	<u>C</u>	2200 – 2400	<u>D</u>	3800 – 4000
<u>A</u>	800 – 1000	<u>C</u>	2400 – 2600		
B	1000 – 1200	<u>C</u>	2600 – 2800		
CONTINUE IN LIKE MANNER WITH E, F, G,.....AS REQUIRED					

EXAMPLE OF SYMBOLS MARKED ON THREE BLADES FROM DIFFERENT MODULES.

BLADE NO. 1:  B = 1200 – 1400 CYCLES
THIS BLADE HAD BEEN A NEW SPARE.

BLADE NO. 2: A B = 1200 – 1400 CYCLES
THIS BLADE HAD BEEN PREVIOUSLY MARKED AT 600 – 800 CYCLE PERIOD.

BLADE NO. 3: T B C = AT LEAST 2400 – 2600 CYCLES
THIS BLADE HAD BEEN A USED SERVICEABLE BLADE OF UNKNOWN CYCLES WHEN FIRST INSTALLED. IT HAD ALSO BEEN REMOVED AND MARKED AT 1200 – 1400 CYCLES PERIOD.

JJ288 (24X2)

Table 2. Low Cycle Fatigue Cycle Marking Code

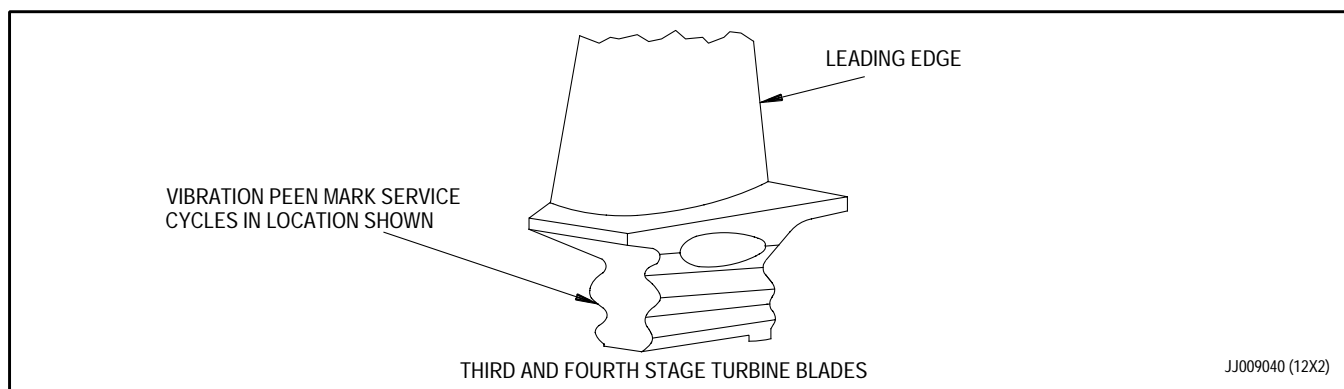


Figure 1. Third and Fourth Stage Turbine Blades - Service Cycle Marking Location

- b. If blade removed from disk is not marked, use total accumulated cycles (TAC).
- c. If blade removed from disk has been previously marked, total accumulated cycles (TAC) to be marked on blade, will be determined as follows:
 - (1) Cycles marked on blade plus cycles accumulated since last blade installation for that disk and blade assembly. Refer to module blade replacement record and engine data records.

(2) For example:

Third stage turbine blade in position No. 7 has code marked on blade root that reflects 600 - 800 cycles. According to low turbine assembly records and 3rd stage turbine disk historical record, AFTO Form No. 44, total cycles on this assembly is presently 1300 cycles. AFTO 44 indicates that blades were last installed when assembly had 400 cycles. Therefore, 900 cycles have accumulated on blade No. 7 since last marking. (1300 minus 400 = 900) Total cycles on blade No. 7 is at least 1500 but not more than 1700.

Minimum: $600 + 900 = 1500$
average 1600

Maximum: $800 + 900 = 1700$

Blade will be marked with B =
1600 to 1800

(3) In above example, blade No. 7 was a used serviceable blade with 600 to 800 cycles when installed in this particular rear compressor drive turbine assembly at 400 cycle period.

d. New spare parts are to be marked with diamond shape symbol prior to installation.

e. Used spare parts for which module origin and cycles are not known shall be marked with Letter T symbol prior to installation.

f. For turbine blade cycle marking, annotate AFTO 44 applicable Turbine Wheel Historical Record just prior to installation of blades into disk as follows:

(1) Under installation data, annotate;

A. Activity accomplishing blade replacement.

B. Turbine assembly/module serial number.

C. Date

D. Installation time in total operating hours.

E, F, G. Record like C. and D.

H. Record total accumulated cycles (TAC).

I. Record hot section times from latest engine data record.

(2) Under Turbine Wheel Blade Data record TOTAL accumulated cycles (TAC) of blade to be installed that has highest number of accumulated cycles.

WORK PACKAGE

TECHNICAL PROCEDURES

TIEROD

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	2	0	3 - 4	28

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. TURBINE TIEROD - INSPECTION.

(See Figure 1.)

NOTE

Tierods to be inspected shall be free of all oil and dirt.

- a. Ensure turbine tierod has been cleaned per WP 201 00.
- b. Visually inspect tierods for cracks. Reject any cracked tierod.
- c. Visually inspect tierods for burrs and raised material on tierod lands. Polish off burrs or raised material to original surface using crocus cloth. See figure 1.
- d. Visually inspect tierods for damaged threads. Remove all pickup and high metal with fine stone. Blend repair. Refer T.O. 2-1-111.
- e. Fluorescent penetrant inspect turbine tierods for cracks. Refer T.O. 2J-F100-9. No cracks allowed.

NOTE

Turbine tierod stretch measurement shall be taken at each turbine disassembly. This requirement holds even if turbine has not been engine operated.

- f. Inspect tierod overall length as follows:
 - (1) Measure overall length using a two inch micrometer.
 - (2) Nominal length of tierod is 1.589 to 1.591 inches.
 - (3) Reject tierods exceeding 1.597 inches (0.006 inch over maximum).

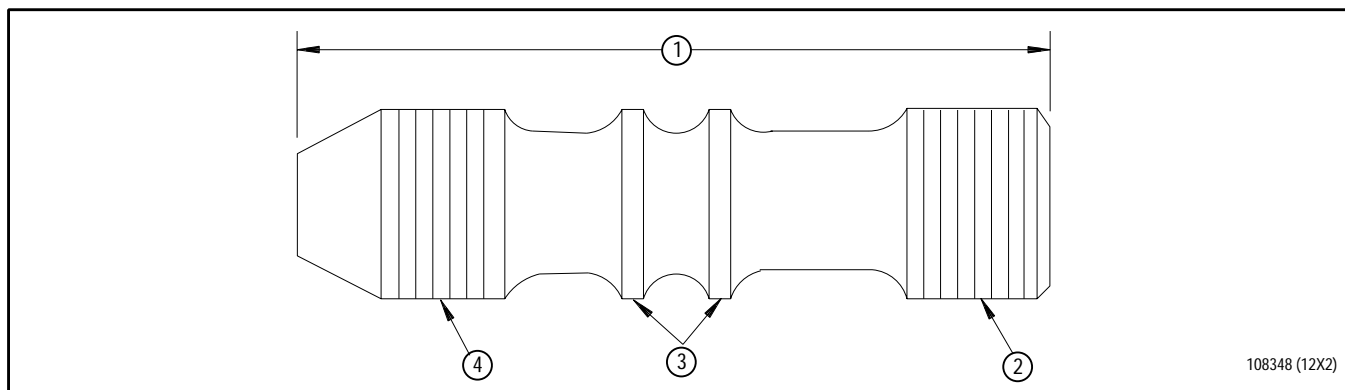


Figure 1. Turbine Tierod - Inspection

1. Tierod length
2. Thread 0.375 - 24 UNJEF - 3A
3. Tierod lands
4. Thread 0.375 - 32 UNJEF - 3A

WORK PACKAGE

TECHNICAL PROCEDURES

HUB ASSEMBLY, TURBINE REAR -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 10

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	30	6	0	8	30
4	0	7	18	9 - 10 Added	30
5	2				

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Nondestructive Inspection Procedure (Repetitive) - Eddy	
Current - - - - -	SWP 004 09
Hub Assembly, Turbine Rear - Inspection - - - - -	SWP 606 01
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module Parts - Cleaning - - - - -	WP 201 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the rear turbine hub assembly.

2. REAR TURBINE HUB ASSEMBLY - INSPECTION.

(See Figures 1 through 4.)



Failure to replace front compressor drive turbine and stator assembly that has undergone an overspeed may result in engine failure.

NOTE

Any low turbine having exceeded 12,400 rpm for 1/2 second or more is considered to have undergone an overspeed.

- a. Replace front compressor drive turbine rotor and stator assembly considered to have undergone an overspeed.
- b. Replace rear compressor drive turbine rotor and stator assembly after reported or suspected engine overtemperature
- c. Ensure rear turbine hub assembly has been cleaned per WP 201 00.
- d. Perform visual and dimensional inspections. (See figure 1.)
- e. Perform dimensional runout if hub was removed from an engine that had blade failure. (See figure 2.) Circular runout and flatness shall be within FIR specified when shaft is mounted on Diameters B and L.
- f. Fluorescent penetrant inspect rear turbine hub assembly for cracks on a system with capability defined in figure 3. Refer to T.O. 2J-F100-9. No cracks allowed.
- g. Eddy current inspect rear turbine hub assembly per requirements of paragraph 3 and figure 4. Refer to T.O. 2J-F100-9.

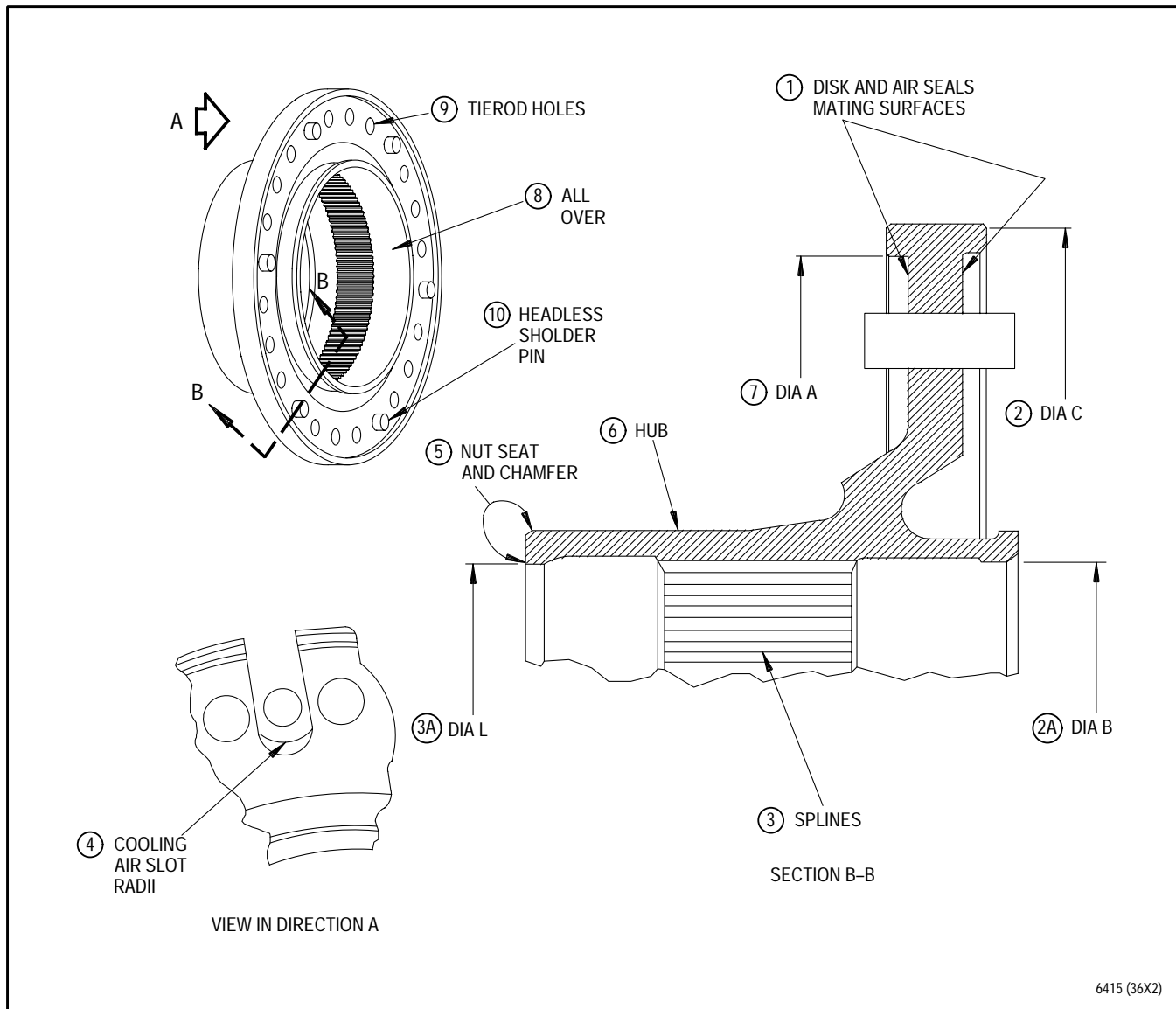


Figure 1. Rear Turbine Hub Assembly - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. Disk and air seals mating surfaces -			
Pits	0.005 inch deep	0.010 inch deep	Nickel plate repair per WP 417 00.
2. Diameter C -			
Pits	0.005 inch deep	0.010 inch deep	Nickel plate repair per WP 417 00.
Wear	Per WP 801 00 Reference 4116	0.010 inch deep	Nickel plate repair per WP 417 00.
2A. Diameter B (Rear ID snap diameter)			
Wear	Per WP 801 00 Reference 4126	0.010 inch deep	Nickel plate repair per WP 417 00.
3. Splines -			
Pits, nicks, dents	Not serviceable	See corrective action	Blend repair per WP 417 00.
Worn and missing antigalling compound	Not serviceable	See corrective action	Apply antigalling compound per WP 417 00.
3A. Diameter L (Front ID snap diameter)	Per 801 00 Reference 4194	0.010 inch deep	Nickel plate repair per WP 417 00.
4. Cooling slots radii -			
Nicks, dents	Not serviceable	Not reparable	Replace hub.
Cracks	Not serviceable	Not reparable	Replace hub.
5. Nut seat and chamfer -			
Scratches, dings, raised metal, or pickup	0.005 inch deep and 0.005 inch wide. No pickup or raised metal allowed.	0.020 inch deep and 0.005 inch wide.	Blend repair per WP 417 00 to remove sharp edges, raised metal, and pickup using fine stone.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
6. Hub (except snap diameters and mating surfaces) -			
Pits	0.005 inch deep	0.010 inch deep	Wet bead blast per WP 417 00.
7. Diameter A -			
Pits	0.005 inch deep	0.010 inch deep	Nickel plate repair per WP 417 00.
Wear	Per WP 801 00 Reference 4116	0.010 inch deep	Nickel plate repair per WP 417 00.
8. All over -			
NOTE			
If hub was removed from engine with blade failure. Check flange closely for cracks.			
Cracks	Not serviceable	Not reparable	Replace hub.
Nicks, dents	Not serviceable	Up to 0.010 inch	Blend repair per WP 417 00.
9. Tierod holes (0.380 to 0.384 inch diameter) -			
Scoring	WP 801 00 Reference 4119	0.010 inch deep. Tierod holes may be repaired, but not more than two adjacent holes per shaft.	Blend repair per WP 417 00 to remove raised material and pickup.
10. Headless shoulder pin -			
Loose, missing	Not serviceable	See corrective action.	Replace pin per WP 417 00.

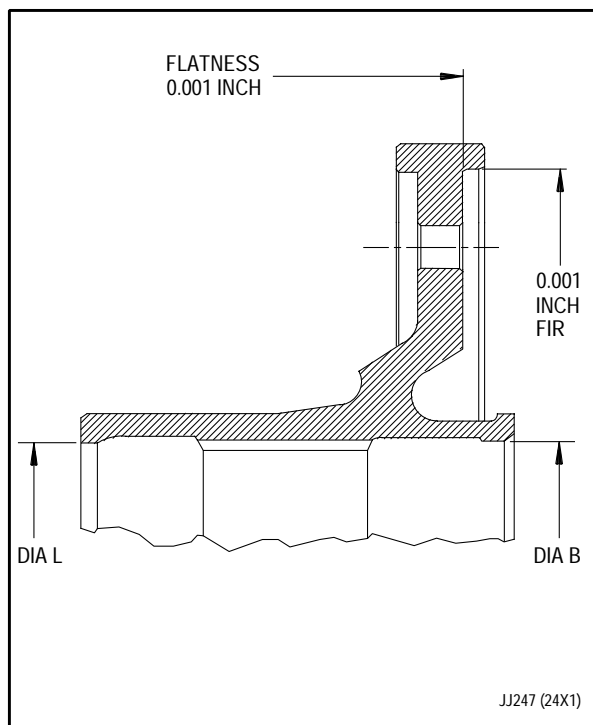


Figure 2. Turbine Rear Hub Assembly - Runout Check

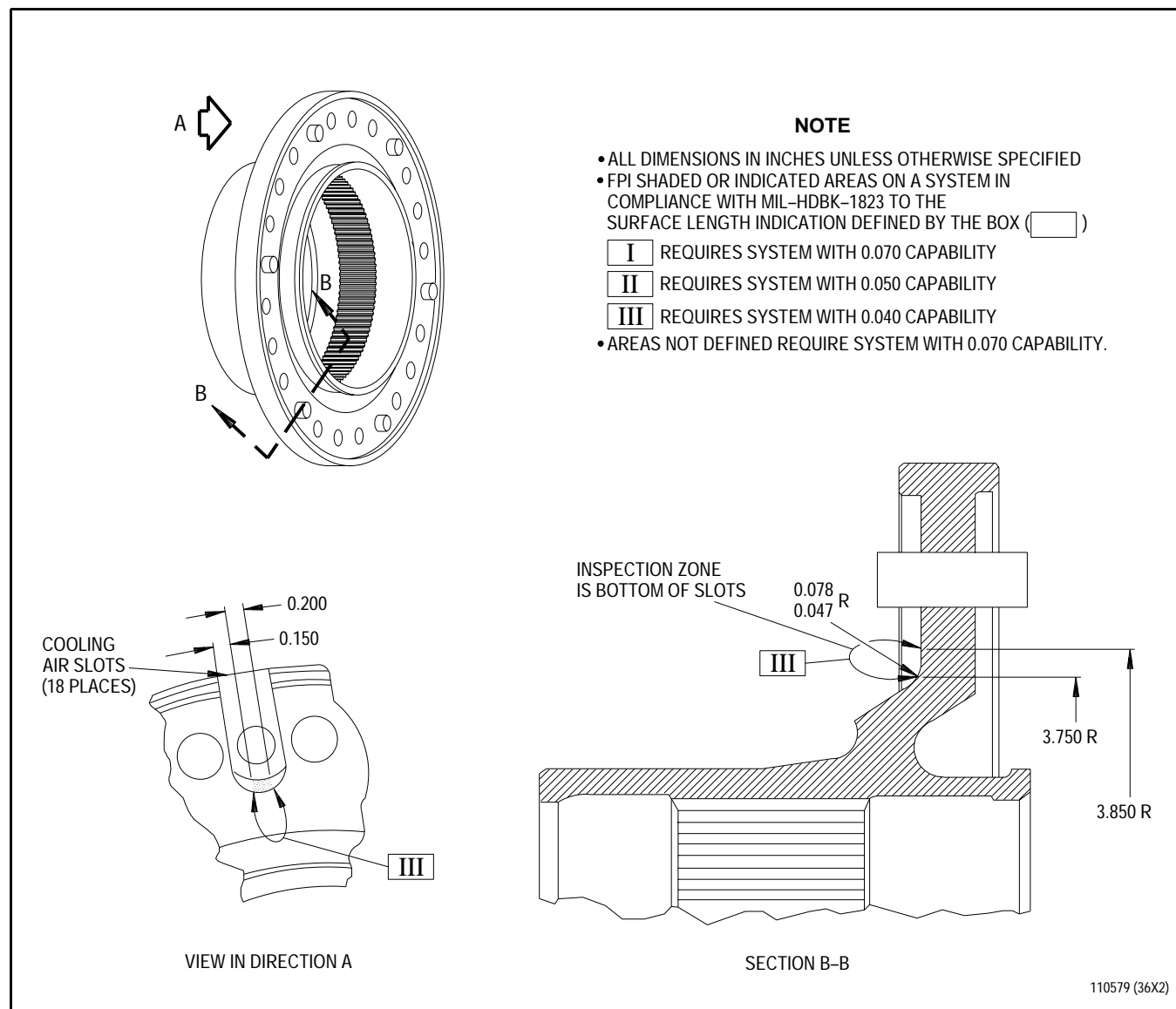
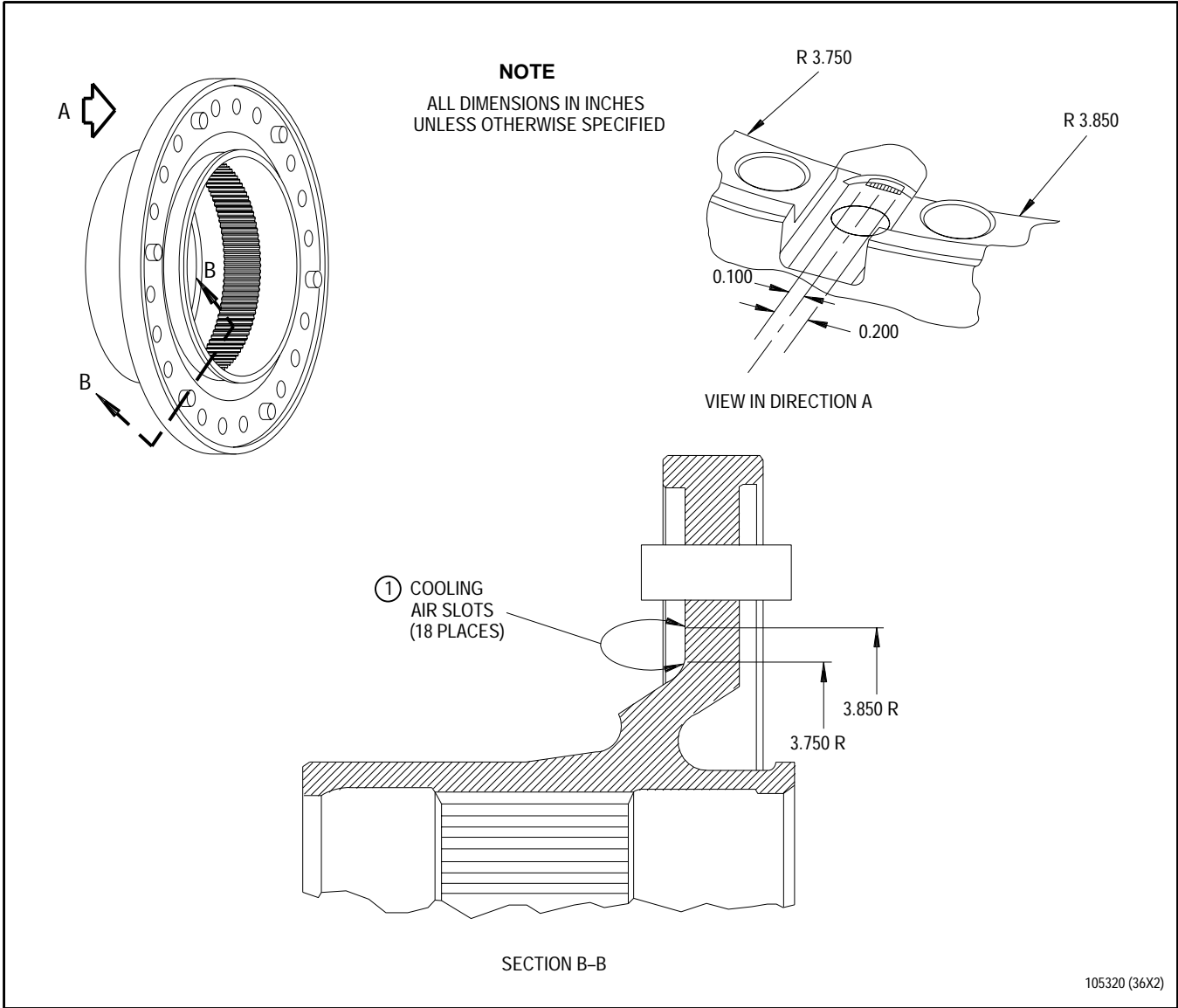


Figure 3. Rear Turbine Hub Assembly - Required Fluorescent Penetrant System Capability

3. EDDY CURRENT INSPECTION USING PN 112366, FULLY AUTOMATED EDDY CURRENT INSPECTION STATION VERSION 3 FOR REAR TURBINE HUB ASSEMBLIES PN 4064229 AND 4080136 AIR SLOTS.

(See Figure 4.)

- a. Ensure that rear turbine hub has been cleaned per WP 201 00.
- b. Prepare ECIS and inspect part.
Refer to T.O. 2J-F100-9,
SWP 004 09 and SWP 606 01.
- c. Inspect rear turbine hub assemblies PN 4064229 and 4080136. Refer to T.O. 2J-F100-9, SWP 606 01.
- d. Evaluate inspection results per figure 4.



Inspection Area	*Maximum Flaw Depth (Inch)	Flaw Surface Orientation	ECIS System Rejection Limits		Corrective Action
			Threshold (Counts)	(a ₅₀ -inch)	
1. Air slots	0.020	Axial Circumferential Radial	2306	0.0167	Replace hub assembly

*Eddy current inspect on system in compliance with MIL-HDBK-1823.

Figure 4. Rear Turbine Hub Assembly - Eddy Current Inspection

WORK PACKAGE

TECHNICAL PROCEDURES

RING - ASSEMBLY OF, AIR SEALING, TURBINE, FOURTH STAGE -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	3	18	4 - 5	0
2	0			6 Blank	0

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 4th stage turbine air sealing ring assembly.

2. FOURTH STAGE TURBINE AIR SEALING RING ASSEMBLY - INSPECTION.

(See Figure 1.)

- a. Ensure 4th stage turbine air sealing ring assembly has been cleaned per WP 201 00.

- b. Inspect 4th stage turbine air sealing ring assembly. (See figure 1.)
- c. Fluorescent penetrant inspect 4th stage turbine air sealing ring assembly for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.

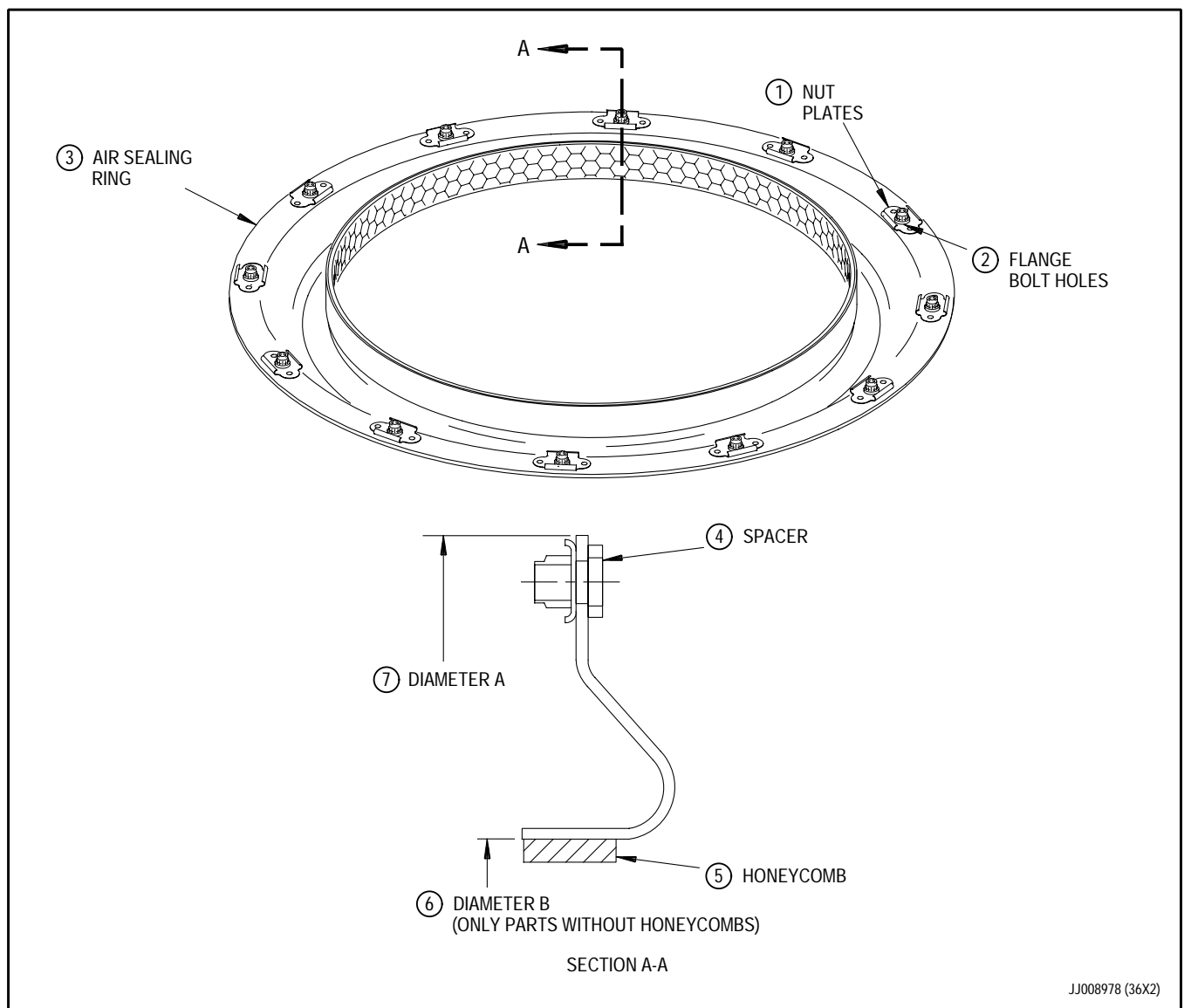


Figure 1. Fourth Stage Turbine Air Sealing Ring Assembly - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. Nut plates -			
Missing loose, cracked, or worn threads	Not serviceable	See corrective action.	Replace nutplate per WP 418 00.
2. Flange boltholes -			
Radial cracks from holeoutward	12 cracks maximum but not more than two adjacent holes with one crack per hole.	Not reparable	Replace air sealing ring assembly.
Radial cracks from holeinward	Not serviceable	Not reparable	Replace air sealing ring assembly.
3. Air sealing ring -			
Cracks	Not serviceable	Not reparable	Replace air sealing ring assembly.
Nicks and dents	Not serviceable	0.020 inch deep	Blend repair per WP 418 00.
4. Spacer -			
Loose, missing	Not serviceable	Not reparable	Replace air sealing ring assembly.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
5. Honeycomb -			
Worn, crushed	Not serviceable	Not repairable	Replace air sealing ring assembly.
Distortion	0.100 inch is acceptable provided tip radial clearance limits are met at assembly.	See corrective action.	Replace air sealing ring assembly.
Loose, missing	Not serviceable	Not repairable	Replace air sealing ring assembly.
Grooves	0.080 inch is acceptable provided grooves are not in backing plate.	See corrective action.	Replace air sealing ring assembly.
6. Diameter B - (only on partswithout Honeycomb)			
Sealingsurface wear	Not serviceable	Not repairable	Replace air sealing ring assembly.
7. Diameter A -			
Wear	12.347 to 12.357 inch diameter	Not repairable	Replace air sealing ring assembly.

WORK PACKAGE

TECHNICAL PROCEDURES

SUPPORT - TURBINE AIR SEALING RING, FOURTH STAGE -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	2	0	3 - 4	18

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 4th stage turbine air sealing ring support.

2. FOURTH STAGE TURBINE AIR SEALING RING SUPPORT - INSPECTION.

(See Figure 1.)

NOTE

One configuration of 4th stage turbine air sealing ring support has lugs, the other configuration has slots.

- a. Ensure 4th stage turbine air sealing ring support has been cleaned per WP 201 00.
- b. Inspect 4th stage turbine air sealing ring support.
(See figure 1.)
- c. Fluorescent penetrant inspect 4th stage turbine air sealing ring support for cracks. Refer to T.O. 2J-F100-9. No cracks allowed.

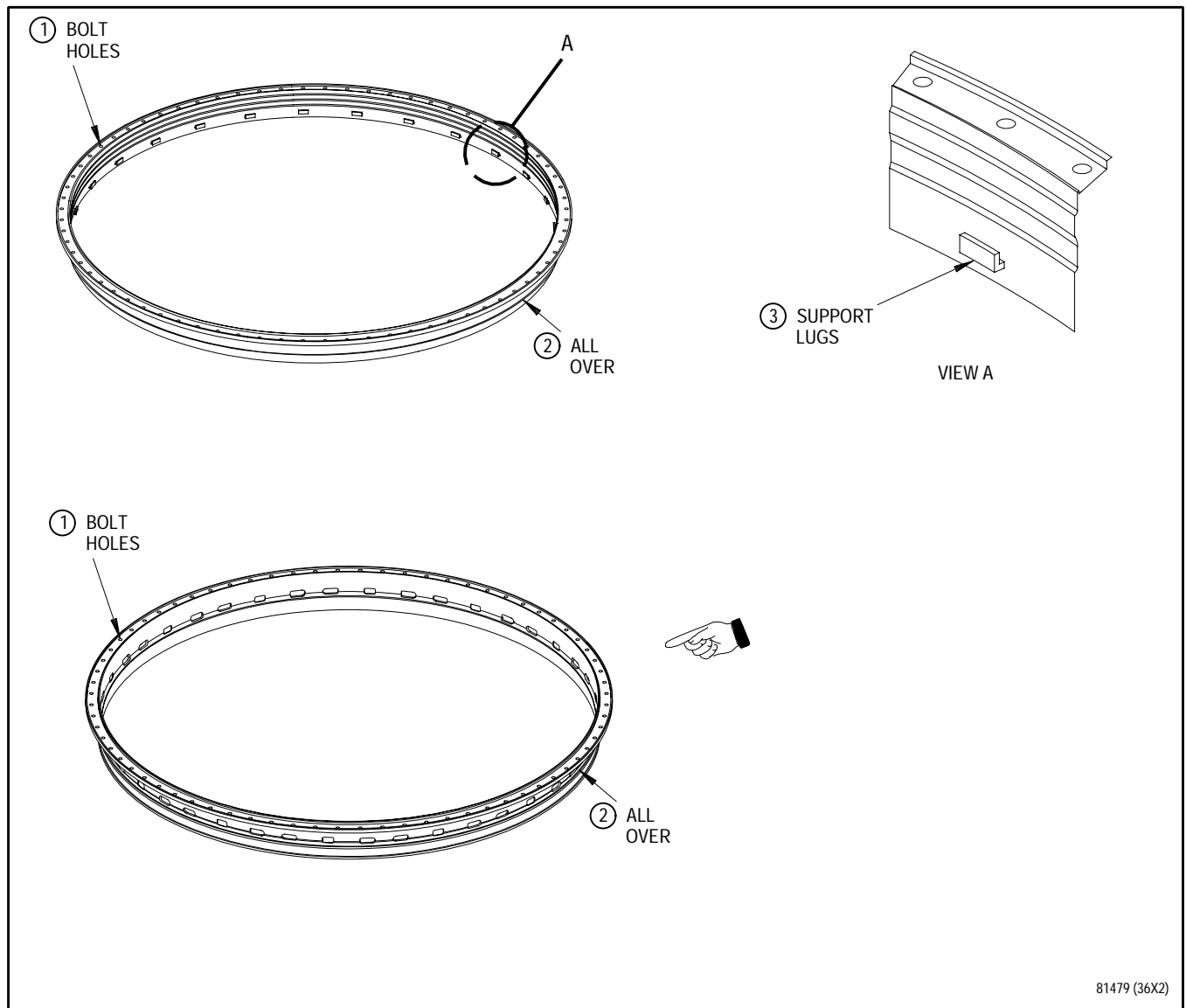


Figure 1. Fourth Stage Turbine Air Sealing Ring Support - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. Bolt holes -			
Elongation	Acceptable up to 0.005 inch in up to ten boltholes in any 180 degree section	Not reparable	Replace air sealing ring support.
Cracks	Not serviceable	Not reparable	Replace air sealing ring support.
2. All over -			
Nicks, dents, and pits	Not serviceable	Up to 0.010 inch deep and 0.062 inch diameter in up to 12 locations. One dent up to 0.015 inch x 0.125 inch diameter allowed.	Blend all sharp edges. Refer to T.O. 2J-F100-53-9 WP 419 00.
Cracks	Not serviceable	Not reparable	Blend. Refer to T.O. 2J-F100-53-9 WP 419 00.
Scratches	Not serviceable	Up to 0.005 inch deep	Blend all sharp edges. Refer to T.O. 2-1-111.
3. Support lugs -			
Wear, chafing	Up to 0.030 inch	Not reparable	Replace air sealing ring support.
Nicks, dents, and pits		Not reparable	Replace air sealing ring support.
Cracks		Not reparable	Replace air sealing ring support.

WORK PACKAGE**TECHNICAL PROCEDURES****AIR SEAL, TURBINE, FOURTH STAGE -****INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 16

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	4 - 5	27	8B Blank Added	27
2	27	6 - 8	18	9 - 11 Added	22
2A - 2B Added	22	8A Added	27	12 Blank Added	22
3	28				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Air Seal, Turbine, Third and Fourth Stages - Repair - - -	WP 410 00
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

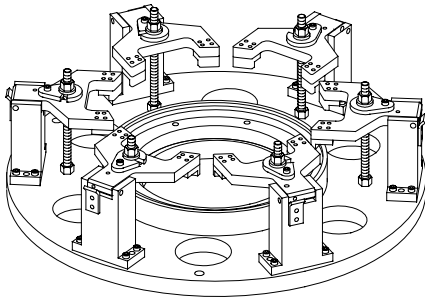
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

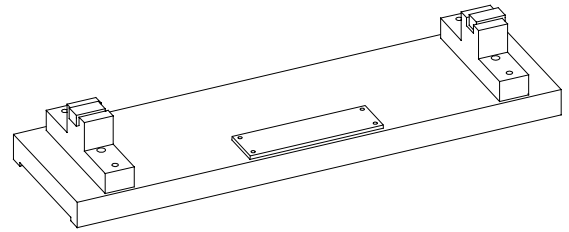
Paragraph	Function - Tool Nomenclature	Tool Number
3	FOURTH STAGE TURBINE AIR SEAL (PN 4081755) - SNAP DIAMETER MEASUREMENT	
	FIXTURE, CONSTRAINT, 4TH STAGE TURBINE AIR SEAL, REAR SNAP DIAMETER - - - - -	PWA 57893
	MASTER, GAGE, 4TH STAGE TURBINE AIR SEAL, FRONT SNAP DIAMETER - - - - -	PWA 57889
	GAGE, 4TH STAGE TURBINE AIR SEAL, FRONT OD SNAP DIAMETER - - - - -	PWA 57890
	FIXTURE, CONSTRAINT, 4TH STAGE TURBINE AIR SEAL, FRONT SNAP DIAMETER - - - - -	PWA 57888
	MASTER, GAGE, 4TH STAGE TURBINE AIR SEAL, REAR SNAP DIAMETER - - - - -	PWA 57891
	GAGE, 4TH STAGE TURBINE AIR SEAL, REAR OD SNAP DIAMETER - - - - -	PWA 57892
	PYROMETER, COMPRESSOR AND TURBINE DISKS/HUBS - - - -	SAALC 8041732
	DIGITAL DISPLAY UNIT, COMPRESSOR AND TURBINE DISKS/ HUBS - - - - -	SAALC 8041733

ILLUSTRATED SUPPORT EQUIPMENT



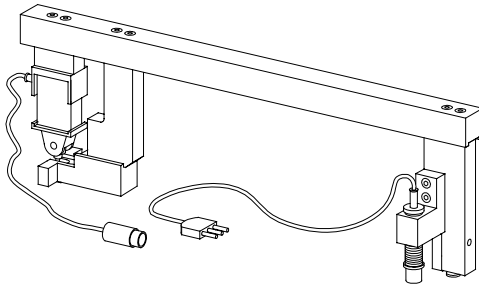
PWA 57888 -C

Figure T1. PWA 57888 FIXTURE



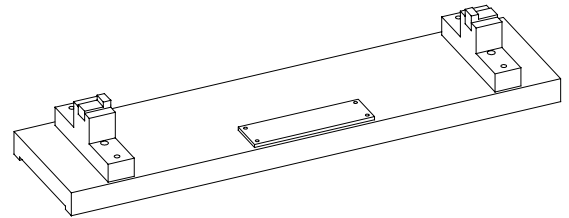
PWA 57889 -C

Figure T2. PWA 57889 MASTER



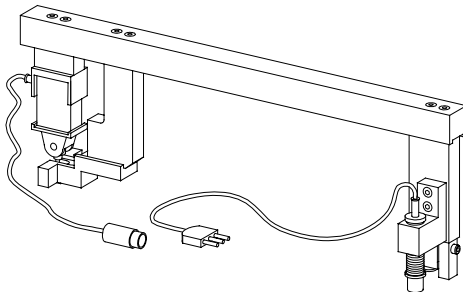
PWA 57890 -C

Figure T3. PWA 57890 GAGE



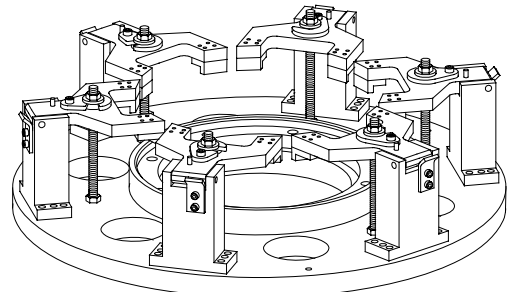
PWA 57891 -C

Figure T4. PWA 57891 MASTER



PWA 57892 -C

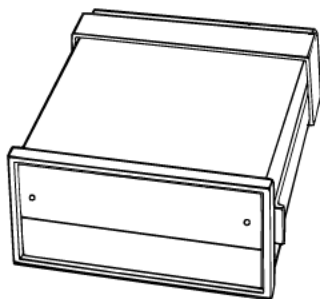
Figure T5. PWA 57892 GAGE



PWA 57893 -C

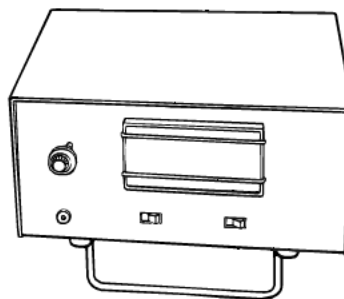
Figure T6. PWA 57893 FIXTURE

ILLUSTRATED SUPPORT EQUIPMENT (continued)



SAALC 8041732 -C

Figure T7. SAALC 8041732 PYROMETER



SAALC 8041733 -C

**Figure T8. SAALC 8041733 DIGITAL DISPLAY
UNIT**

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 4th stage turbine air seal.

2. FOURTH STAGE TURBINE AIR SEAL - INSPECTION.

(See Figures 1 through 4.)



Failure to replace front compressor drive turbine and stator assembly that has undergone an overspeed may result in engine failure.

NOTE

Any low turbine having exceeded 11,530 rpm for 1/2 second or more is considered to have undergone an overspeed.

- a. Replace 4th stage turbine air seal considered to have undergone an overspeed.

- b. Ensure 4th stage turbine air seal has been cleaned per WP 201 00.
- c. Visually inspect 4th stage turbine air seal. (See figures 1 and 4.)
- d. Fluorescent penetrant inspect 4th stage turbine air seal for cracks on a system with capability defined in figure 2. Refer to T.O. 2J-F100-9. No cracks allowed. All crack indications observed are cause for rejection and require Material Review Board (MRB) evaluation. (See figure 2.)
- e. Eddy current inspect 4th stage turbine air seal per requirements of figure 3.
- f. Measure 4th stage turbine air seal snap diameters per paragraph 3.

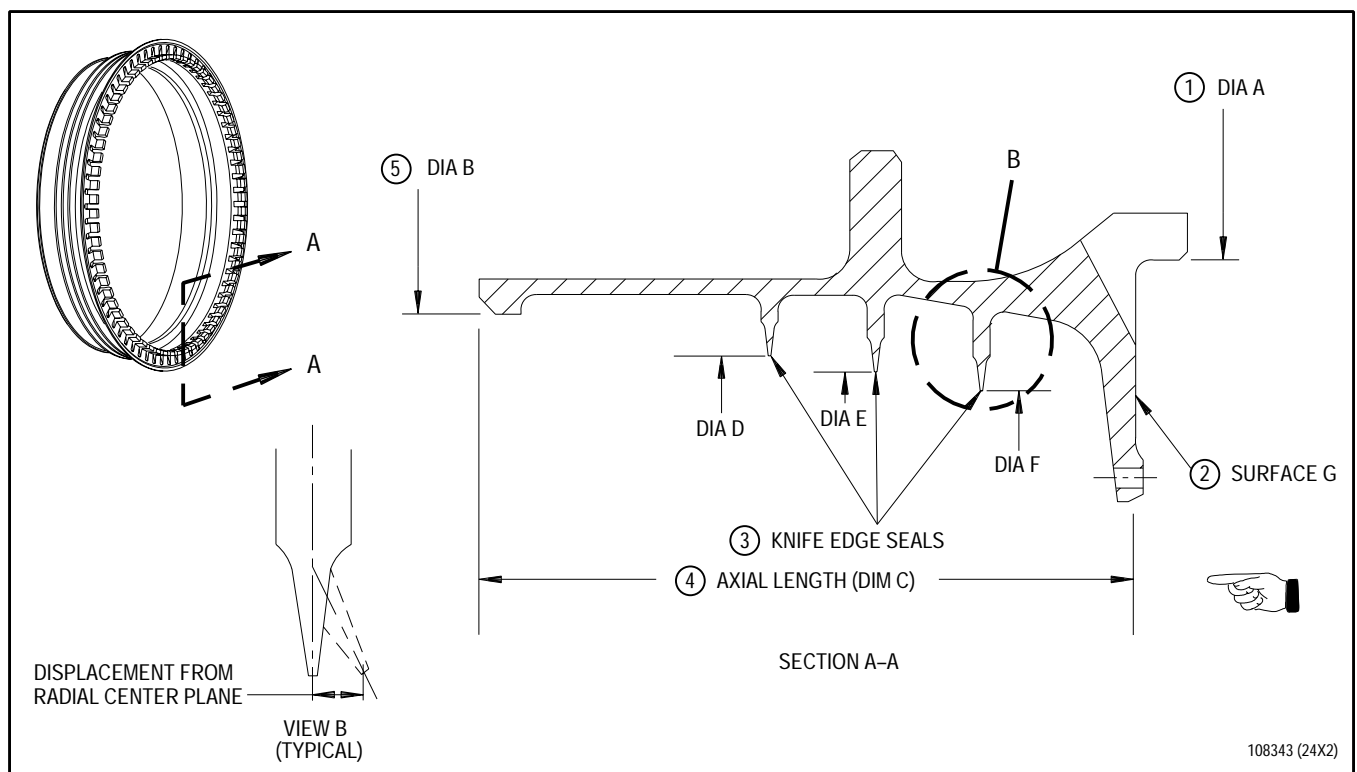


Figure 1. Fourth Stage Turbine Air Seal - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Diameter A -			
Wear	Per WP 801 00 Reference 4148.	Not reparable	Replace air seal.
2. Surface G			
Wear	0.010 inch deep	See corrective action	Replace air seal.
3. Knife-edge seals -			
Wear	Average minimum diameters: Diameter D 14.771 inches, Diameter E 14.921 inches, Diameter F 15.071 inches	Average minimum diameters: Diameter D 14.763 inches, Diameter E 14.913 inches, Diameter F 15.063 inches	Strip and recoat per WP 410 00.
Nicks and dents	Not serviceable	Damage is reparable if final blend meets blend limits in WP 410 00.	Blend repair per WP 410 00.
Cracks	Not serviceable	Not reparable	Replace air seal.
Bent	0.500 inch long per knife edge. 0.050 inch maximum displacement from radial center plane	Damage is reparable if final blend meets blend limits in WP 410 00.	Blend repair per WP 410 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
3. Knife-edge seals (continued) -			
Chipped or missing coating	Coating may be chipped or missing in up to six 0.250 inch long areas, but must be separated by at least one inch per knife-edge. See figure 4.	Any amount	Strip and recoat per WP 410 00.
4. Axial length (Dimension C) -			
Wear	2.794 to 2.798 inch dimension	Not reparable	Replace air seal.
5. Diameter B -			
Wear	Refer to T.O. 2J-F100-53-9, WP 801 00, Reference 4159.	Not reparable	Replace air seal.

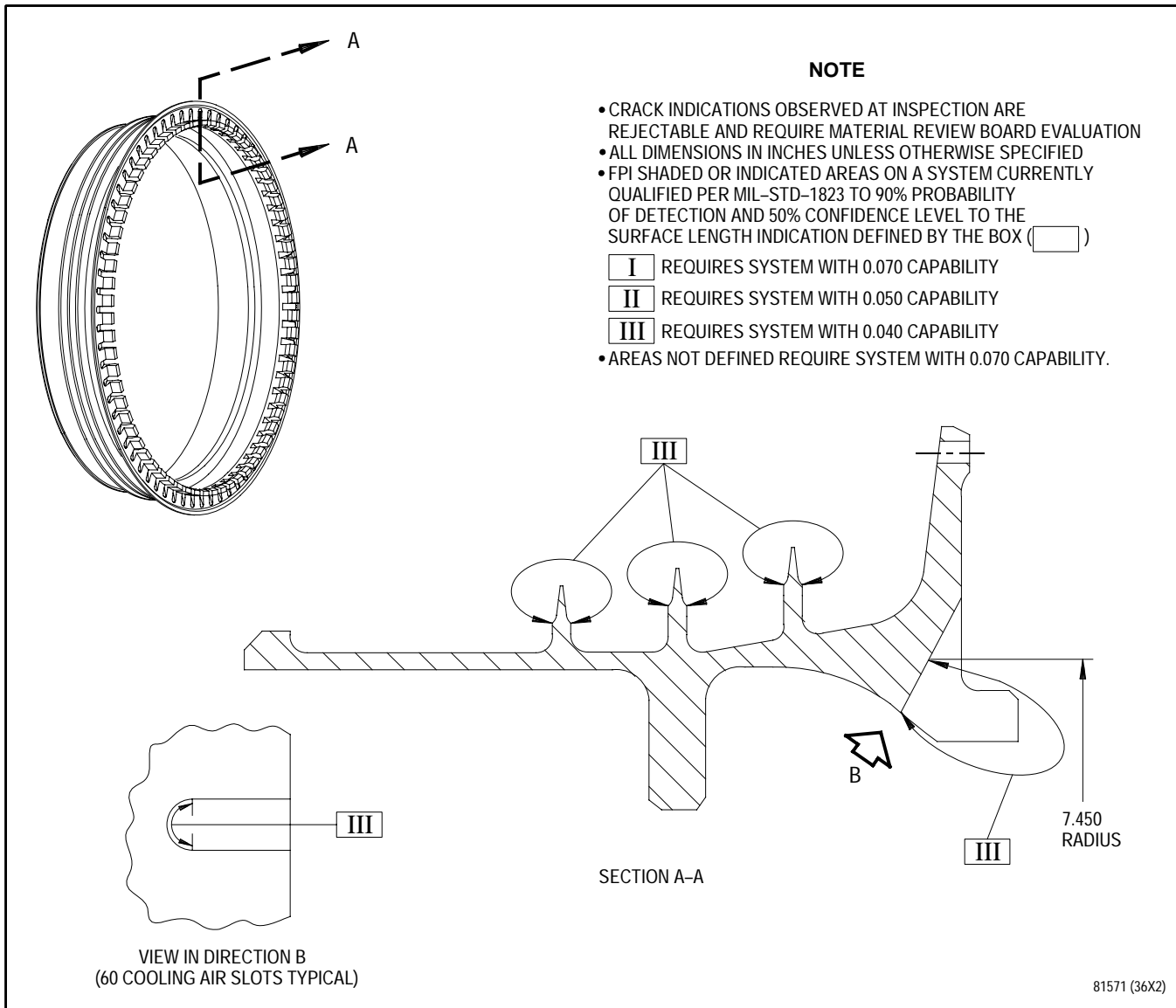


Figure 2. Fourth Stage Turbine Air Seal - Required Fluorescent Penetrant System Capability

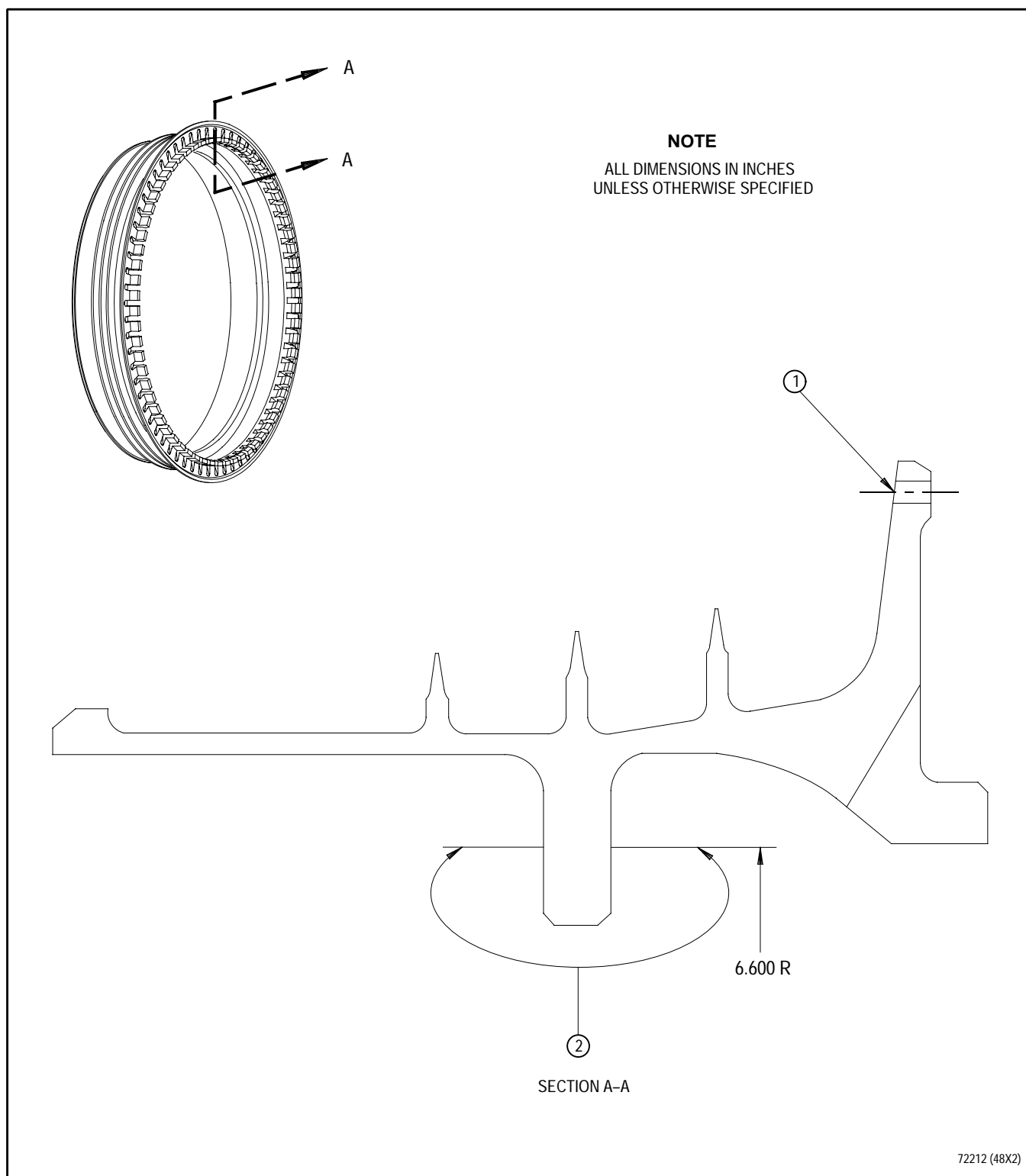


Figure 3. Fourth Stage Turbine Air Seal - Eddy Current Inspection

Legend for figure 3

	Inspection Area	*Maximum Flaw Depth (Inch)	Flaw Surface Orientation	SRL System Rejection Limit		Corrective Action
				(Counts)	(A50-inch)	
1.	Air seal pin hole	0.015	Axial	TBD	TBD	Replace air seal
2.	Bore	0.010	Axial Radial	TBD	TBD	Replace air seal

*Eddy current inspect on system currently qualified per MIL-STD-1823 at 90% probability of detection and 50% confidence level for required flaw depth.

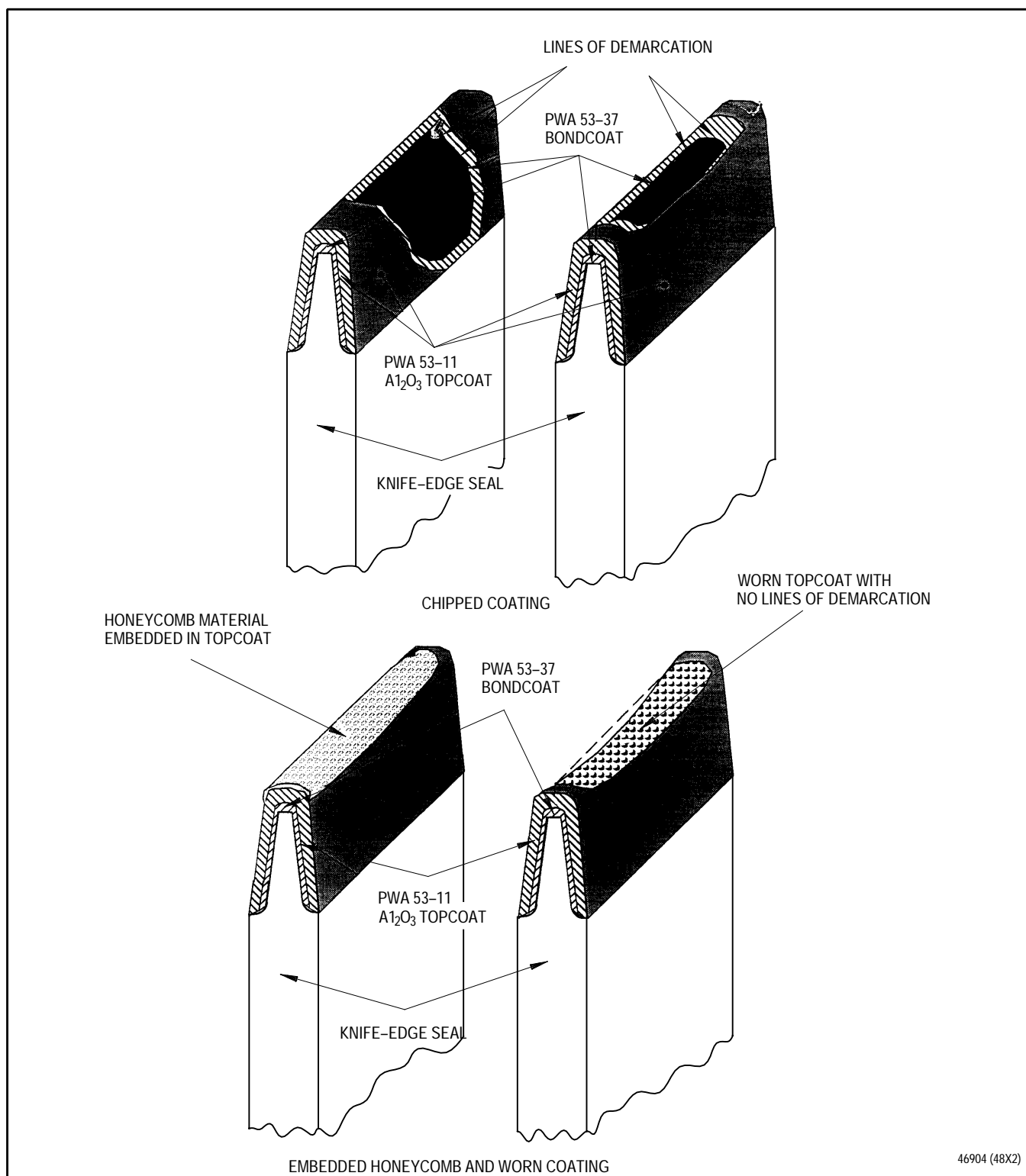


Figure 4. Fourth Stage Turbine Air Seal - Chipped Coating, Embedded Honeycomb, and Worn Coating

3. FOURTH STAGE TURBINE AIR SEAL (PN 4081755) - SNAP DIAMETER MEASUREMENT.

(See Tables 1 and 2.)

NOTE

Two constraint fixtures exist. Measure air seal front snap diameter using PWA 57893 per step(a). Measure air seal rear snap diameter using PWA 57888 per step(d).

- a. Place PWA 57893 constraint fixture on cordax or surface plate. Secure if required. Install air seal in fixture as follows:
 - (1) Swing clamps (six) out of position so air seal can be placed into fixture.
 - (2) Wipe fixture locating surfaces clean. Visually check for imperfections.
 - (3) Place air seal, front side down, into fixture so it rests on locating ring.
 - (4) Swing clamps (six) into position on air seal. Install swing C-washer assemblies over clamps.



Failure to properly torque nuts will damage air seal.

- (5) Install nuts and torque 250 to 300 pound-inches.



Failure to properly handle equipment used to measure diameters may result in damage to equipment.

NOTE

PWA 57889 master shall be used to calibrate PWA 57890 gage prior to measuring air seal front snap diameter.

- b. Place PWA 57889 master on a sturdy, flat surface.
- c. Install PWA 57890 gage on PWA 57889 master, carefully contacting gage indicator foot to gage flat on master. Proceed to step(g).
- d. Place PWA 57888 constraint fixture on cordax or surface plate. Secure if required. Install air seal in fixture as follows:
 - (1) Swing clamps (six) out of position so air seal can be placed into fixture.
 - (2) Wipe fixture locating surfaces clean. Visually check for imperfections.
 - (3) Place air seal, rear side down, into fixture so it rests on locating ring.
 - (4) Swing clamps (six) into position on air seal. Install swing C-washer assemblies over clamps.



Failure to properly torque nuts will damage air seal.

- (5) Install nuts and torque 250 to 300 pound-inches.



Failure to properly handle equipment used to measure diameters may result in damage to equipment.

NOTE

PWA 57891 master shall be used to calibrate PWA 57892 gage prior to measuring air seal front snap diameter.

- e. Place PWA 57891 master on a sturdy, flat surface.
- f. Install PWA 57892 gage on PWA 57891 master, carefully contacting gage indicator foot to gage flat on master.
- g. Connect thermocouple lead from gage to SAALC 8041732 pyrometer.

NOTE

Pyrometer operates from either 100 to 125 vac or 190 to 250 vac, 48 to 400 hz power source. Operating instructions appear in pyrometer manual.

- h. Connect pyrometer to appropriate power source.
- i. Attach lead from electronic gage head to SAALC 8041733 digital display unit. Follow operating instructions in display unit manual.
- j. Connect digital display unit to power source.
- k. Set digital unit zero adjusting knob to 5.

- l. Press carbide tipped end of gage flat against master gaging flat. Swing gage head right, then left until lowest reading possible appears on digital display unit. Digital unit readout should be ± 0.0008 inch maximum.
- m. When reading is more than ± 0.0008 inch, loosen screws holding gage head. Adjust gage head position by contacting appropriate gaging flats of master until a reading of ± 0.0008 inch maximum appears on digital display unit. Tighten gage head screws.
- n. Recheck display unit reading to ensure that acceptable reading is maintained.
- o. Maintaining acceptable reading with gage set on master, adjust dial on display unit to show all zeros prior to measuring air seal diameter.

NOTE

- Space is provided in Table 1 to record specific information.
- Dimension etched on brass tag of master is diameter in a controlled 68°F (20°C) environment and it shall be used to determine actual air seal diameter.
- p. Record temperature of master as indicated by pyrometer.
- q. Carefully remove electrically connected gage from master and install on air seal, locating on diameter to be measured.

- r. Grip gage holding solid end against air seal and swing contacting gage indicator foot to right, then left slightly. Record reading shown on digital display unit. Take a minimum of two readings at equally spaced locations. Average the readings and record as minimum dimensional variance.
- s. Record temperature of air seal as indicated by pyrometer.
- t. Determine actual air seal diameter by following steps outlined in tables 1 and 2.

Table 1. Computing Actual Air Seal Diameter

Step	Description	Dimension or Temperature
1	Dimension etched on master	
2	Temperature of master	
3	Master temperature variance (step 2 minus 68°F (20°C))(+/ -)	
4	Master dimension correction (see table 2)(+/ -)	
5	Master dimension* (step 1 ± step 4)	
6	Minimum dimensional variance	
7	Air seal dimension** (step 5 ± step 6)	
8	Temperature of air seal	
9	Air seal temperature variance (step 8 minus 68°F (20°C))	
10	Air seal dimension correction (see table 2)(+/ -)	
11	Actual air seal diameter at 68°F (20°C)*** (step 7 ± step 10)	

* If the temperature of the master is lower than 68°F (20°C), subtract dimension correction.

** If the minimum dimensional variance is in the positive range, add variance. If the minimum dimensional variance is in the negative range, subtract variance.

*** If the temperature of the air seal is higher than 68°F (20°C), subtract dimension correction. If the temperature of the air seal is lower than 68°F (20°C), add dimension correction.

Table 2. Seal-Air, Turbine, 4th Stage - Temperature Dimension Correction

Air Seal Diameter Inches	Combined Temperature Variance														
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
6-8	.00005	.00010	.00015	.00020	.00025	.00030	.00035	.00045	.00050	.00055	.00060	.00065	.00070	.00075	.00080
8-10	.00005	.00015	.00020	.00025	.00035	.00040	.00050	.00055	.00060	.00070	.00075	.00080	.00090	.00095	.00105
10-12	.00010	.00015	.00025	.00035	.00040	.00050	.00060	.00065	.00075	.00085	.00090	.00100	.00110	.00115	.00125
14-16	.00010	.00025	.00035	.00045	.00055	.00070	.00080	.00090	.00105	.00115	.00125	.00135	.00150	.00160	.00170
16-18	.00015	.00025	.00040	.00050	.00065	.00080	.00090	.00105	.00115	.00130	.00140	.00155	.00170	.00180	.00195
Air Seal Material is PWA 1016															

WORK PACKAGE

TECHNICAL PROCEDURES

RING SEGMENT - ASSEMBLY OF, AIR SEALING, TURBINE, FOURTH STAGE -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	3	18	4	16
2	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1A.Tab wear, chafing	Up to 0.060 inch	Not reparable	Replace air sealing ring segments.
2. Honeycomb rubstrip - Distortion	Up to 0.100 inch	Any amount	Replace honeycomb per WP 421 00.
Grooves	Up to 0.060 inch depth provided no missing honeycomb cells in groove and no grooves in backing plate.	Any amount	Replace honeycomb per WP 421 00.
3. Typical missing honeycomb area -			

NOTE

Remove any loose honeycomb prior to determining total missing area. Total missing honeycomb area may consist of a series of small damaged areas but maximum axial width of any damage is 0.500 inch.

Missing (axial width)	Up to 0.500 inch axial width for total of 1 square inch missing area per segment. See circumferential length below.	Not reparable	Replace honeycomb per WP 421 00.
Missing (circumferential length)	Circumferential length of missing honeycomb area is controlled by axial width. Example for one missing area: 0.250 inch axial width permits 4 inches circumferential length. See axial width.	Not reparable	Replace honeycomb per WP 421 00.
4. All over - Cracks	Not serviceable	Not reparable	Replace air sealing ring segments.
Wear, chafing	Up to 0.030 inch	Not reparable	Replace air sealing ring segments.

WORK PACKAGE**TECHNICAL PROCEDURES****DISK ASSEMBLY - TURBINE, FOURTH STAGE -****INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 16

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	30	3	22	7	22
2	22	4 - 5	30	8 - 10	18
2A Added	22	6	0	11 - 13 Added	22
2B Blank Added	22			14 Blank Added	22

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Cloth, abrasive crocus	P-C-458

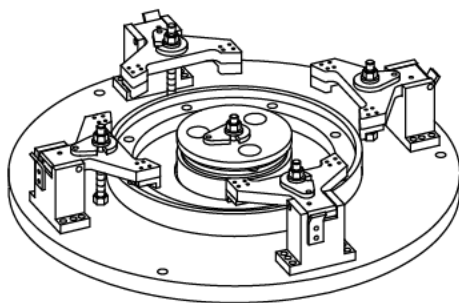
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

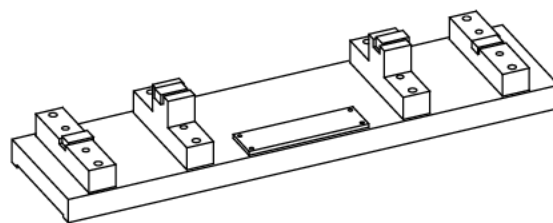
Paragraph	Function - Tool Nomenclature	Tool Number
4	FOURTH STAGE TURBINE DISK (PN 4082604) - SNAP DIAMETER MEASUREMENT	
	FIXTURE, CONSTRAINT, 4TH STAGE TURBINE DISK, FRONT	PWA 57874
	MASTER, GAGE, 4TH STAGE TURBINE DISK, FRONT - - - -	PWA 57875
	GAGE, 4TH STAGE TURBINE DISK, FRONT INNER SNAP DIAMETER - - - - -	PWA 57876
	GAGE, 4TH STAGE TURBINE DISK, FRONT OUTER SNAP DIAMETER - - - - -	PWA 57877
	PYROMETER, COMPRESSOR AND TURBINE DISKS/HUBS - - - -	SAALC 8041732
	DIGITAL DISPLAY UNIT, COMPRESSOR AND TURBINE DISKS/ HUBS - - - - -	SAALC 8041733

ILLUSTRATED SUPPORT EQUIPMENT



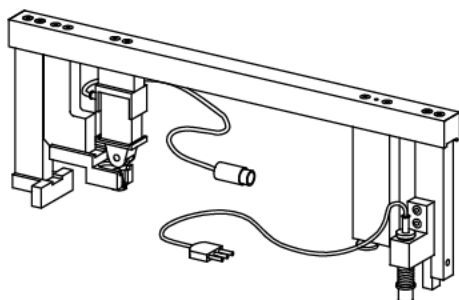
PWA 57874 -C

Figure T1. PWA 57874 FIXTURE



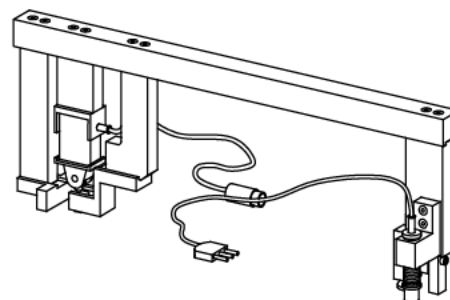
PWA 57875 -C

Figure T2. PWA 57875 MASTER



PWA 57876 -C

Figure T3. PWA 57876 GAGE



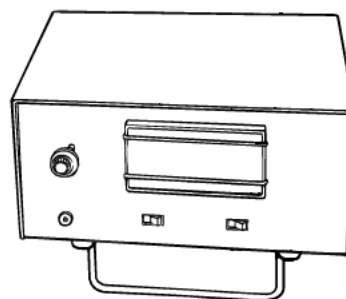
PWA 57877 -C

Figure T4. PWA 57877 GAGE



SAALC 8041732 -C

Figure T5. SAALC 8041732 PYROMETER



SAALC 8041733 -C

Figure T6. SAALC 8041733 DIGITAL DISPLAY UNIT

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 4th stage turbine disk.

2. FOURTH STAGE TURBINE DISK - INSPECTION.

(See Figures 1 through 3.)



Failure to replace front compressor drive turbine and stator assembly that has undergone an overspeed may result in engine failure.

NOTE

Any low turbine having exceeded 11,500 rpm for 1/2 second or more is considered to have undergone an overspeed.

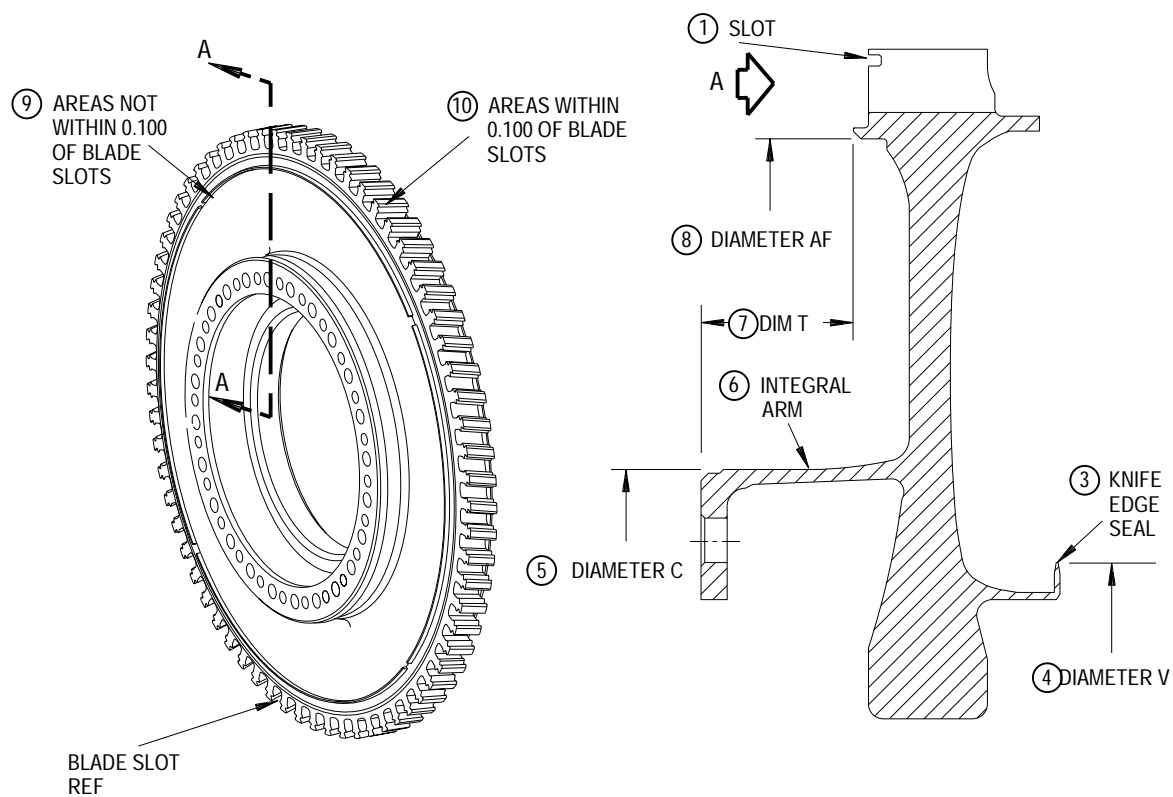
- a. Replace front compressor drive turbine rotor and stator assembly considered to have undergone an overspeed
- b. Clean disk immediately before inspection per WP 201 00.



Presence of cracks or other unusual conditions confirmed by fluorescent penetrant or visual inspection are cause for rejection; unserviceable conditions can result in engine damage.

- c. Visually inspect 4th stage turbine disk using fluorescent (white) light and a 10X magnifying glass for surface damage. Depth of damage, especially on curved areas or areas which are difficult to observe, may be more easily determined by comparison with samples having known damage depths. If disk has been blend-repaired, perform nondestructive inspection per T.O. 2J-F100-9. (See figure 1.)

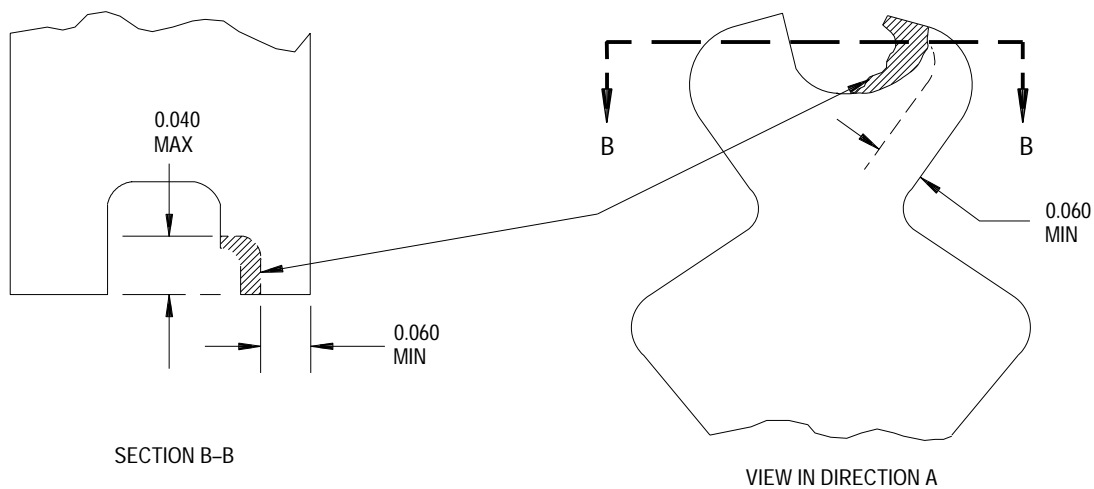
- d. Pay particular attention to areas where defects are difficult to find, such as tierrod, counterweight and lightening holes, and to critical areas such as blade slots and bore.
- e. Fluorescent penetrant inspect 4th stage turbine disk for cracks on a system with capability defined in figure 2. Refer to T.O. 2J-F100-9. No cracks allowed. All crack indications observed are cause for rejection and require Material Review Board (MRB) evaluation. (See figure 2.)
- f. Rework of any disk that has a crack or any indication not clearly the result of localized damage such as nicks, dents, or scratches is not permissible.
- g. Evaluation of surface shall take into consideration need for repairs and limits to which repairs may be made. Some conditions are acceptable without repairs; however, it is desirable to blend repair these areas. The sharper the surface damage, the more desirable it is to blend area. Nondestructive inspect blend repairs per T.O. 2J-F100-9.
- h. Acceptability and reparability of specific areas shall be made. (See figure 1.)
- i. Perform stretch measurement per paragraph 3.
- j. Measure 4th stage turbine disk PN 4082604 snap diameters per paragraph 4.
- k. Eddy current inspect 4th stage turbine disk per requirements of figure 3. Refer to T.O. 2J-F100-9.



SECTION A-A

NOTE

ALL DIMENSIONS IN INCHES
UNLESS OTHERWISE SPECIFIED



111065 (48X2)

Figure 1. Fourth Stage Turbine Disk - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. Slot - Wear	Not serviceable	0.040 inch deep 0.060 inch minimum wall	Blend repair per WP 422 00.
2. Deleted			
3. Knife-edge seal - condemnation.			

NOTE

Nicks and dents greater than maximum reparable limits are cause for part

Smooth dents (without cracks)	Not serviceable	See limits for nicks, dents, small cracks	Blend repair, observing maximum reparable limits for nicks and dents per WP 422 00.
Nicks, dents, small cracks	Not serviceable	a. One inch maximum length for single blend. b. Two inch maximum cumulative circumferential length per knife-edge. (More than one blend.) c. Maximum depth of blend shall not exceed 0.045 inch.d. Both ends of each blended repair shall have minimum of 1/8 inch radius.	Blend repair per WP 422 00.
4. Diameter V - (For J-seal configuration only)			
Wear	Per WP 801 00, Reference 4120.	Not reparable	Replace disk.
5. Diameter C -			
Wear	Per WP 801 00, Reference 4116.	Not reparable	Replace disk.
6. Integral arm -			
Cracks	Not serviceable	Not reparable	Replace disk.
Nicks and dents	Not serviceable	0.005 inch deep	Blend repair per WP 422 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
7. Dimension T -			
Wear, dishing	Per WP 801 00, Reference 4143.	Not reparable	Replace disk.
8. Diameter AF -			
Wear, disk growth	Per WP 801 00, Reference 4148.	Not reparable	Replace disk.
Stretch	See paragraph 3.	Not reparable	Replace disk.
9. Areas not within 0.100 inch of blade slots -			
Cracks	Not serviceable	Not reparable	Replace disk.
Nicks, dents	Not serviceable	0.005 inch deep	Blend repair per WP 422 00.
Scratches	Not serviceable	a. 0.005 inch deep b. One inch long	Blend repair per WP 422 00.
Corrosion	Not serviceable	a. 0.002 inch deep b. Two square inches	Blend repair per WP 422 00.
10. Areas within 0.100 inch of blade slots -			
Nicks, dents, scratches	Not serviceable	0.005 inch deep	Blend repair per WP 422 00.
Cracks	Not serviceable	Not reparable	Replace disk.

3. FOURTH STAGE TURBINE DISK - STRETCH MEASUREMENT - INSPECTION.

(See Figure 1.)

- a. For disks with stretch measurement marked on OD of disk adjacent to pin(1, figure 1) compute stretch as follows:
 - (1) Measure Diameter AF(8) in four places equally spaced per paragraph 4. Compute average diameter.
 - (2) Compare average measured diameter to original diameter marked on disk front face.
- b. For disks without stretch measurement markings, compute stretch as follows:
 - (1) Measure Diameter AF(8) in four places equally spaced. Compute average diameter.
 - (2) Compare measurement to that recorded on AFTO form 44.
- c. Replace disk if measured diameter exceeds marked diameter by more than 0.004 inch or replace disk if measured diameter exceeds 14.662 inches.

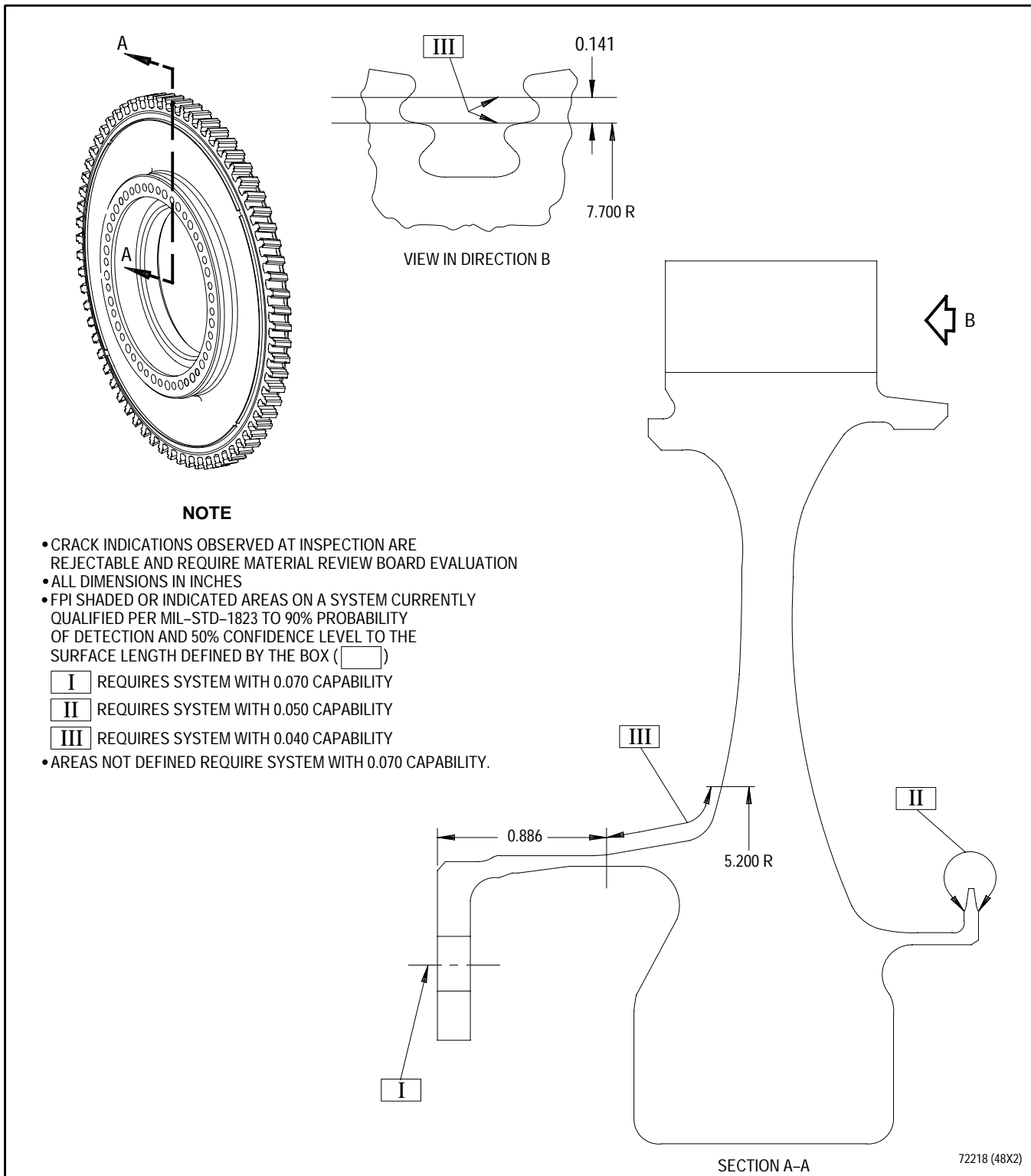
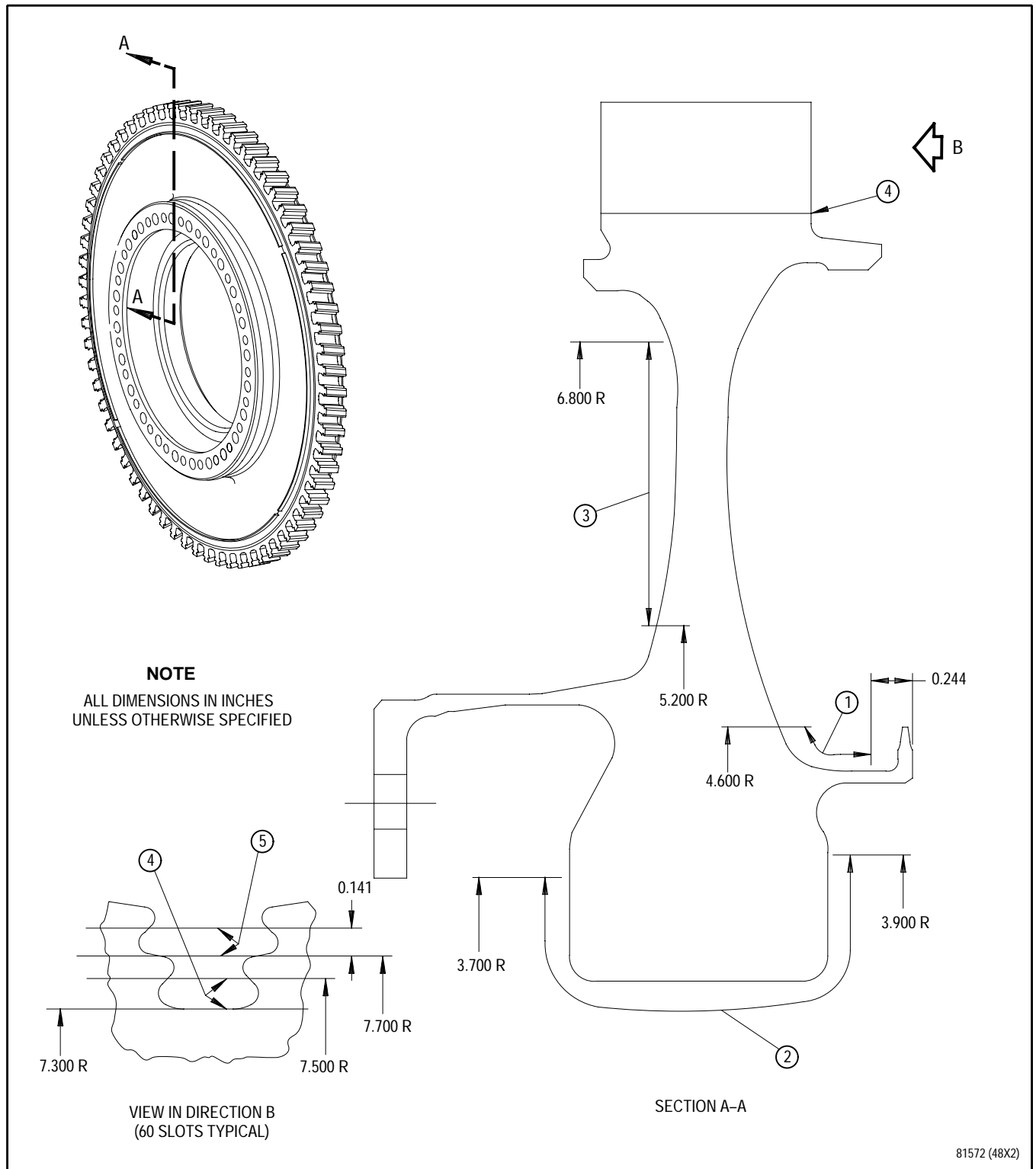


Figure 2. Fourth Stage Turbine Disk - Required Fluorescent Penetrant System Capability



81572 (48X2)

Figure 3. Fourth Stage Turbine Disk - Eddy Current Inspection

Legend for figure 3

Inspection Area	*Maximum Flaw Depth (Inch)	Flaw Surface Orientation	SRL System Rejection Limit		Corrective Action
			(Counts)	(A50-inch)	
1. Disk integral arm	0.017	Circumferential Radial	TBD	TBD	Replace disk
2. Disk bore	0.016	Axial Radial	TBD	TBD	Replace disk
3. Disk front inner web	0.007	Circumferential	TBD	TBD	Replace disk
4. Broach slots ID, 60 places	0.015	Axial	TBD	TBD	Replace disk
5. Broach slots OD, 60 places	0.020	Axial	TBD	TBD	Replace disk

*Eddy current inspect on system currently qualified per MIL-STD-1823 at 90% probability of detection and 50% confidence level for required flaw depth.

4. FOURTH STAGE TURBINE DISK (PN 4082604) - SNAP DIAMETER MEASUREMENT.

(See Tables 1 and 2.)

- a. Place PWA 57874 constraint fixture on cordax or surface plate. Secure, if required. Install disk assembly in fixture as follows:

- (1) Remove clamp plate assembly and swing C-washer assembly from center stud.
- (2) Swing C-washers (four places) and rotate clamps out of position so disk assembly can be placed into fixture.
- (3) Wipe inner and outer locating ring surfaces clean. Visually check for imperfections.
- (4) Install 4th stage turbine disk, rear side down, onto fixture so disk rests on locating rings.
- (5) Install clamp plate over center stud.



Failure to properly torque nuts may damage disk.

- (6) Install clamp plate swing C-washer assembly. Install clamp plate nut on center stud and torque 400 to 450 pound-inches.
- (7) Swing clamps (four) into position on disk assembly. Install swing C-washer assemblies over clamps. Install nuts and torque 300 to 350 pound-inches.

- b. Measure 4th stage turbine disk front inner and outer snap diameters as follows:



Failure to handle precision instruments with care may result in damage.

- (1) Place PWA 57875 master on a steady, flat surface.

NOTE

Two snap diameter gages exist. Use PWA 57876 gage to measure 4th stage turbine disk front inner snap diameter. Use PWA 57877 gage to measure 4th stage turbine disk front outer snap diameter

- (2) Install appropriate gage on PWA 57875 master, carefully contacting gage indicator foot to gage flat on master.
- (3) Connect thermocouple lead from gage to SAALC 8041732 pyrometer.

NOTE

Pyrometer operates from either 100 to 125 vac or 190 to 250 vac, 48 to 400 hz power source. Operating instructions appear in pyrometer manual.

- (4) Connect pyrometer to appropriate power source.
- (5) Attach lead from electronic gage head to SAALC 8041733 digital display unit. Follow operating instructions in display unit manual.

- (6) Connect digital display unit to power source.
- (7) Set digital unit zero adjusting knob to 5.
- (8) Press carbide tipped end of gage flat against master gaging flat. Swing gage head right, then left until lowest reading possible appears on digital display unit. Digital unit readout should be ± 0.0008 inch maximum.
- (9) When reading is more than ± 0.0008 inch, loosen screws holding gage head. Adjust gage head position by contacting appropriate gaging flats of master until a reading of ± 0.0008 inch maximum appears on digital display unit. Tighten gage head screws.
- (10) Recheck display unit reading to ensure that acceptable reading is maintained.
- (11) Maintaining acceptable reading with gage set on master, adjust dial on display unit to show all zeros prior to measuring disk diameter.

NOTE

- Space is provided in Table 1 to record specific information.
 - Dimension etched on brass tag of master is diameter in a controlled 68°F (20°C) environment and shall be used to determined actual disk diameter.
- (12) Record temperature of master as indicated by pyrometer.
 - (13) Carefully remove electrically connected gage from master and install on disk, locating on diameter to be measured.
 - (14) Grip gage holding solid end against disk and swing contacting gage indicator foot to right, then left slightly. Record reading shown on digital display unit. Take a minimum of two readings at equally spaced locations. Average the readings and record as minimum dimensional variance.
 - (15) Record temperature of disk as indicated by pyrometer.
 - (16) Determine actual disk diameter by following steps outlined in tables 1 and 2.

Table 1. Computing Actual Disk Diameter

Step	Description	Dimension or Temperature
1	Dimension etched on master	
2	Temperature of master	
3	Master temperature variance (step 2 minus 68°F (20°C))(+/-)	
4	Master dimension correction (see table 2)(+/-)	
5	Master dimension* (step 1 ± step 4)	
6	Minimum dimensional variance	
7	Disk dimension** (step 5 ± step 6)	
8	Temperature of disk	
9	Disk temperature variance (step 8 minus 68°F (20°C))	
10	Disk dimension correction (see table 2)(+/-)	
11	Actual disk diameter at 68°F (20°C)*** (step 7 ± step 10)	

* If the temperature of the master is lower than 68°F (20°C), subtract dimension correction.

** If the minimum dimensional variance is in the positive range, add variance.
If the minimum dimensional variance is in the negative range, subtract variance.

*** If the temperature of the disk is higher than 68°F (20°C), subtract dimension correction. If the temperature of the disk is lower than 68°F (20°C), add dimension correction.

Table 2. Fourth Stage Turbine Disk - Temperature Dimension Correction

Disk Diameter Inches	Combined Temperature Variance														
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
6-8	.00005	.00010	.00015	.00020	.00025	.00030	.00035	.00045	.00050	.00055	.00060	.00065	.00070	.00075	.00080
8-10	.00005	.00015	.00020	.00025	.00035	.00040	.00050	.00055	.00060	.00070	.00075	.00080	.00090	.00095	.00105
10-12	.00010	.00015	.00025	.00035	.00040	.00050	.00060	.00065	.00075	.00085	.00090	.00100	.00110	.00115	.00125
14-16	.00010	.00025	.00035	.00045	.00055	.00070	.00080	.00090	.00105	.00115	.00125	.00135	.00150	.00160	.00170
16-18	.00015	.00025	.00040	.00050	.00065	.00080	.00090	.00105	.00115	.00130	.00140	.00155	.00170	.00180	.00195
Disk Material is PWA 1106															

WORK PACKAGE

TECHNICAL PROCEDURES

GUIDE - NO. 5 BEARING ROLLER -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	11	3	11	4 Blank	0
2	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

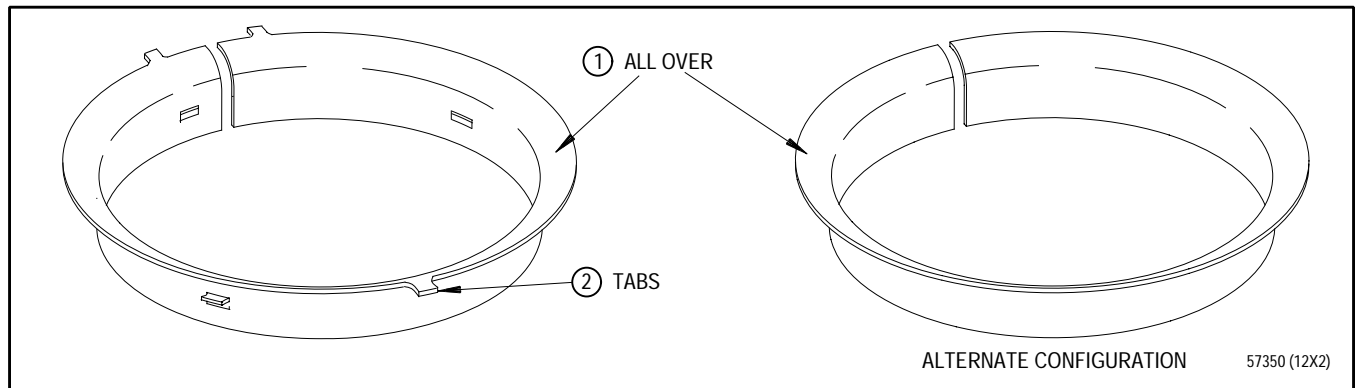
1. INTRODUCTION.

- a. This work package contains instructions for inspection of No. 5 bearing roller guide.

2. NO. 5 BEARING ROLLER GUIDE - INSPECTION.

(See Figure 1.)

- a. Inspect No. 5 bearing roller guide. (See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. All over -			
Nicks, dents, scratches, burrs	Not serviceable	See corrective action	Blend to remove burrs and high metal with fine stone.
Cracks	Not serviceable	Not repairable	Replace roller guide.
2. Tabs -			
Missing, cracked	Not serviceable	Not repairable	Replace roller guide.

Figure 1. No. 5 Bearing Roller Guide - Inspection

WORK PACKAGE

TECHNICAL PROCEDURES

CASE - ASSEMBLY OF, TURBINE EXHAUST -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	4	28	6	28
2	0	5	0	7	19
3	18			8	0

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Compound, antigalling (PWA 36035)	Fel-Pro C-300

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the turbine exhaust case assembly.

2. TURBINE EXHAUST CASE ASSEMBLY - INSPECTION.

(See Figure 1.)

- a. Ensure turbine exhaust case assembly has been cleaned per WP 201 00.
- b. Inspect turbine exhaust case assembly. (See figure 1.)

- c. Fluorescent penetrant inspect turbine exhaust case assembly for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.

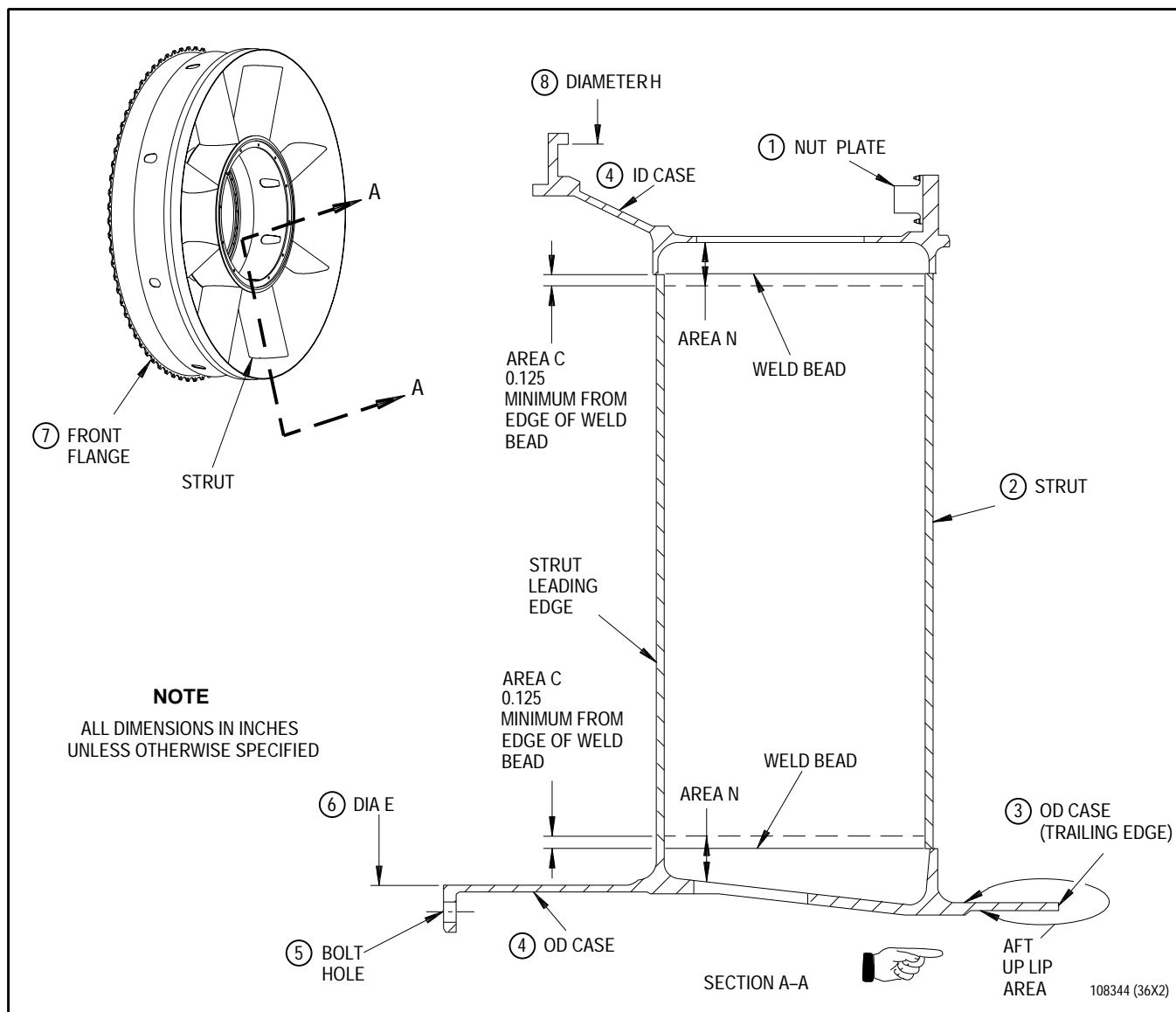


Figure 1. Turbine Exhaust Case Assembly - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Nut plate -			
Damage	Not serviceable	See corrective action.	Replace nut plate per WP 424 00.
Loose, missing	Not serviceable	See corrective action.	Replace nut plate per WP 424 000.
Worn threads	See paragraph 3	See corrective action.	Replace nut plate per WP 424 00.
2. Strut -			
Cracks (general)	Not serviceable	Two cracks with .500 inch minimum separation on each side of strut, 1.500 inch maximum length each crack. No weld allowed in Area C.	Weld repair per WP 424 00.
Cracks (Area C)	Not serviceable	Not repairable. No cracks or weld allowed in this area.	Replace turbine exhaust case assembly.
Support rod interference with strut welds	Not serviceable	See corrective action.	Blend repair per WP 424 00.
Dents	a. Ten per strut, round-bottom, 0.250 inch maximum diameter and 0.125 inch depth. b. Unlimited number is less than 0.130 inch deep	Any amount	Reshape surface per WP 424 00.
Dent accompanied by hole	Not serviceable	Dent 0.030 inch maximum depth with hole. 0.250 inch maximum diameter.	Repair per WP 424 00.
Foreign material splatter	No concentrated areas larger than 0.020 inch diameter and not over 0.010 inch above strut surface.	Concentrated areas not over 0.100 inch wide by 1.000 inch long and not over 0.050 inch above strut surface.	Remove material by polishing with a fine abrasive until smooth to touch. No change in strut contour allowed.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
2. Strut - (continued)			
Local distortion	Not serviceable	Not repairable	Replace turbine exhaust case assembly.
Oil tube strut, tube/heat shield interference with strut welds	Not serviceable	See corrective action.	Blend repair per WP 424 00.
3. OD Case			
Cracks, trailing edge (0.500 inch) (entire circumference)	Up to 0.060 inch	Not repairable	Replace turbine exhaust case assembly.
Cracks between struts	Up to 0.125 inch	Not repairable	Replace turbine exhaust case assembly.
Cracks within 0.500 inch of struts	Not serviceable	Not repairable	Replace turbine exhaust case assembly.
Cracks, from front flange to LE of strut (entire circumference)	Not serviceable	Not repairable	Replace turbine exhaust case assembly.
Distortion, trailing edge	Local radial distortion allowed but clearance envelope dia. of 31.500 inches must be maintained over entire circumference	Not repairable	Replace turbine exhaust case assembly.
Dents, trailing edge	Round-bottom dents acceptable. No cracks	Not repairable	Replace turbine exhaust case assembly.
Knicks, trailing edge	Not serviceable	See corrective action.	Blend repair per WP 424 00.
Chafing, trailing edge, due to contact with spray ring supports	Not serviceable	See corrective action.	Blend repair per WP 424 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
4. ID Case and OD Case -			
Cracks	Not serviceable	Not repairable. No stop drilling or welding allowed.	Replace turbine exhaust case assembly.
Rub on ID (area of struts)	Not serviceable	Not repairable	Replace turbine exhaust case assembly.
5. Bolthole -			
Radial cracks outward from hole	0.030 inch, 15 cracks maximum but not more than two adjacent holes with one crack per hole	Not repairable	Replace turbine exhaust case assembly.
Radial cracks inward from hole	None allowed	Not repairable	Replace turbine exhaust case assembly.
6. Diameter E (4th stage turbine airsealing ring support OD snap diameter)			
Wear deterioration	Not serviceable	Not repairable	Replace turbine exhaust case assembly.
7. Front flange -			
Out-of-round	0.095 inch allowable in free state	Not repairable	Replace turbine exhaust assembly.
Bent, out-of-flat	Not serviceable	Not repairable	Replace turbine exhaust case assembly.
8. Diameter H (No. 5 bearing seal support snap diameters) -			
Wear deterioration	Per WP 801 00 Reference 4122	Not repairable	Replace turbine exhaust case assembly.

3. REAR FAIRING NUTPLATE - INSPECTION.

a. Inspect rear fairing nutplate locking feature as follows:

(1) Brush thin coating Fel-Pro C-300 antigalling compound on thread and washer face of MS969609 bolt. Do not use bolt with stripped or damaged threads.

(2) Thread bolt into nutplate by hand. If bolt can be threaded past the locking feature with moderate finger torque the nutplate is not acceptable, and go to step b. Continue at seven other locations, using freshly coated bolts.

(3) If step a.(2) is acceptable, measure friction torque with bolt in steady clockwise rotation. If torque exceeds 25 pound-inches prior to seating, the nutplate is not acceptable and go to step b.

b. Replace nutplate per WP 424 00.

WORK PACKAGE

TECHNICAL PROCEDURES

SEAL - ASSEMBLY OF, NO. 5 BEARING -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	14	4	14	7	14
2 - 3	0	5 - 6	0	8 Blank	0

REFERENCE MATERIAL REQUIRED

Title	Number
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Cloth, abrasive crocus	PC-458

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of No. 5 bearing seal assembly.

2. NO. 5 BEARING SEAL ASSEMBLY - INSPECTION.

(See Figure 1.)

- a. Inspect No. 5 bearing seal assembly. (See figure 1.)



Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. No. 5 bearing seal pin -			
Wear, scratches, and nicks	Not serviceable	Wear marks, scratches, and nicks up to 0.002 inch in depth.	Polish with fine crocus cloth per WP 425 00.
Damaged, loose, missing, bent, cracked securing flare	Not serviceable	Not reparable	Replace pin per WP 425 00.
2. Boss -			
Damaged	Not serviceable	See corrective action.	Remove raised metal and pickup per WP 425 00
3. Bolt holes in front flange -			
Damaged	Not serviceable	Not reparable	Replace No. 5 bearing seal assembly.
4. Boss threads -			
Damaged	Not serviceable	Any amount of pickup or high metal.	Chase threads. Refer to T.O. 2-1-111. (Flush boss when complete.) Remove raised metal and pickup per WP 425 00
5. Diameter A -			
Worn	Refer to WP 801 00 Reference 4131	Not reparable	Replace No. 5 bearing seal assembly.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
6. Surface C - Galled	Not serviceable	0.003 inch deep	Blend repair per WP 425 00.
7. Surface D - Galled, nicks, dents, and scratches	Not serviceable	0.003 inch deep by 0.010 inch wide. Max of 6 locations.	Blend repair per WP 425 00.
8. No. 5 bearing seal assembly - Cracked	Not serviceable	Not reparable	Replace No. 5 bearing seal assembly.
Surface damage nicks, dents, scratches	Not serviceable	0.010 inch deep 0.010 inch wide	Blend repair per WP 425 00.
9. Surface B - Galled	Not serviceable	0.003 inch deep	Blend repair per WP 425 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
10. No. 5 bearing heat shield -			
Cracks	Not serviceable	Not reparable	Replace No. 5 bearing heat shield per WP 425 00.
Holes, punctures	Not serviceable	Not reparable	Replace No. 5 bearing heat shield per WP 425 00.
11. Helical compression spring seat -			
Damaged, loose, missing, bent cracked securing flare	Not serviceable	Not reparable	Replace spring seat per WP 425 00.
12. Turbine exhaust case snap diameter -			
Wear	Per WP 801 00 Reference 4122	Not reparable	Replace No. 5 bearing seal assembly.
13. Seal ring groove -			
Wear, scratches, fretting, grooves	Not serviceable	Not reparable	Replace No. 5 bearing seal assembly.
Oil deposits, grit, coke	Not serviceable	See corrective action	Clean groove per WP 201 00.

WORK PACKAGE

TECHNICAL PROCEDURES

NUT, BEARING RETAINING (EXTERNALLY THREADED) -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	3	18	4	0
2	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Cloth, abrasive crocus	PC 458

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

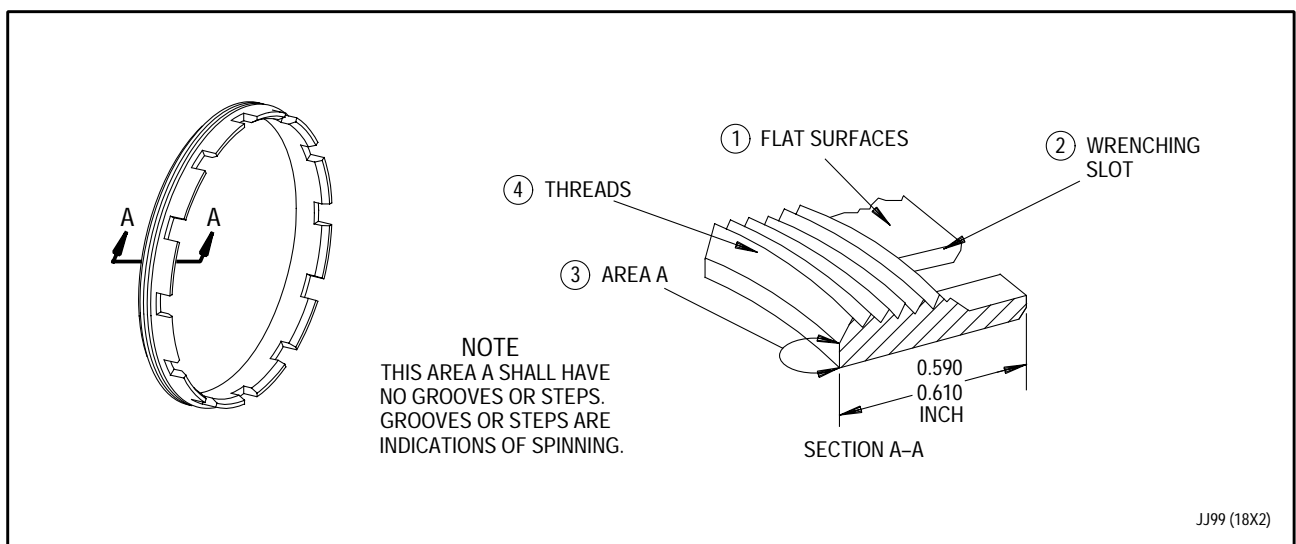
1. INTRODUCTION.

- a. This work package contains instructions for inspection of the No. 5 bearing outer race retaining nut.

2. NO. 5 BEARING OUTER RACE RETAINING NUT - INSPECTION.

(See Figure 1.)

- a. Ensure No. 5 bearing outer race retaining nut has been cleaned per WP 201 00.
- b. Magnetic particle inspect retaining nut. Refer to T.O. 2J-F100-9. No cracks allowed.
- c. Visually inspect. (See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Flat surfaces - Burrs, galling, scoring, tool damage	Not serviceable	See corrective action.	Blend using crocus cloth or fine sandpaper with nut mounted on surface plate.
2. Wrenching slots - Damage, tool marks	Not serviceable	See corrective action.	Remove burrs using file or fine stone.

Figure 1. No. 5 Bearing Retaining Nut - Inspection

Legend for figure 1 (continued)

Inspection Area -Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3. Area A - Wear	Acceptable provided 0.590 to 0.610 inch dimension is maintained and spinning is not evident.	Not repairable	Replace nut.
4. Threads - Wear, excessive damage	Not serviceable	All thread pick up and high metal shall be removed	Remove high metal and pick up with fine abrasive stone.

WORK PACKAGE

TECHNICAL PROCEDURES

SEAT-BALL SOCKET, NO. 5 BEARING SUPPORT -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4					0

REFERENCE MATERIAL REQUIRED

Title	Number
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Ball End - Rod, No. 5 Bearing Support - Inspection - - - - -	WP 328 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Cloth, abrasive crocus	P-C-458

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the No. 5 bearing support ball socket seat.

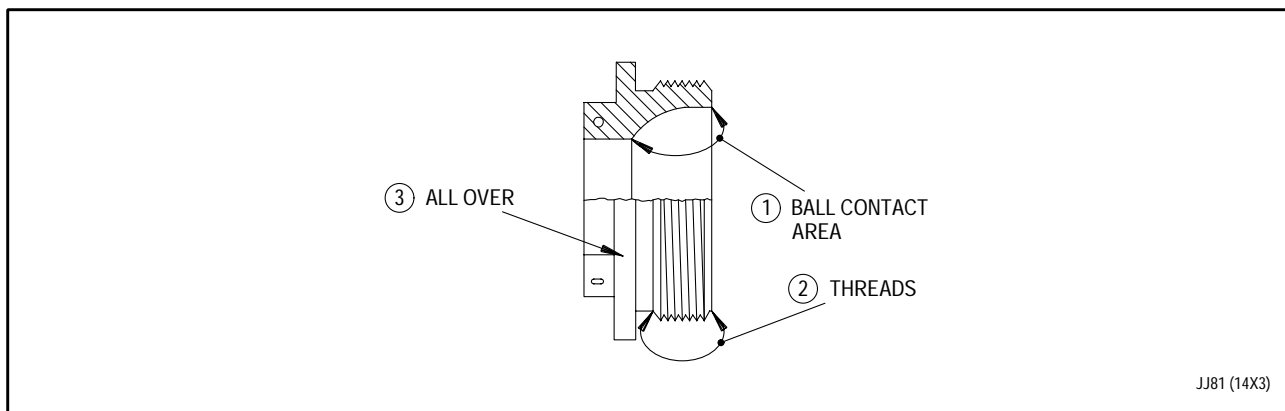
2. NO. 5 BEARING SUPPORT BALL SOCKET SEAT - INSPECTION.

(See Figure 1.)

- a. Inspect No. 5 bearing support ball socket seat.
(See figure 1.)

NOTE

When inspecting ball contact, No. 5 bearing support ball socket seat, and No. 5 bearing support rod ball-end must be mated together. Refer to T.O. 2J-F100-53-9, WP 328 00. After inspection, keep parts together in sets and identify with location.



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Ball contact area - Nicks, dents, scratches	Not serviceable	0.015 inch deep. All pickup and high metal must be removed.	Blend to remove pickup and high metal with fine stone. Clean with fine emery paper and polish with fine crocus cloth P-C-458. Avoid making circumferential grooves.

Figure 1. No. 5 Bearing Support Ball Socket Seat - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. Ball contact area - (continued)			
Pits	Not serviceable	0.015 inch deep	Clean with light emery paper and polish with fine crocus cloth P-C-458. Avoid making circumferential grooves.
Grooves	0.030 inch deep, provided 60% of contact surface is not affected	Not reparable	Replace No. 5 bearing support ball socket seat.
2. Threads -			
Damaged	Not serviceable	All thread pickup and high metal shall be removed.	Remove high metal and pickup with fine abrasive stone.
3. All over -			
Cracks	Not serviceable	Not reparable	Replace No. 5 bearing support ball socket seat.

WORK PACKAGE

TECHNICAL PROCEDURES

BALL-END-ROD, NO. 5 BEARING SUPPORT -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
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REFERENCE MATERIAL REQUIRED

Title	Number
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Seat-Ball Socket, No. 5 Bearing Support - Inspection - - -	WP 327 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the No. 5 bearing rod ball-end.

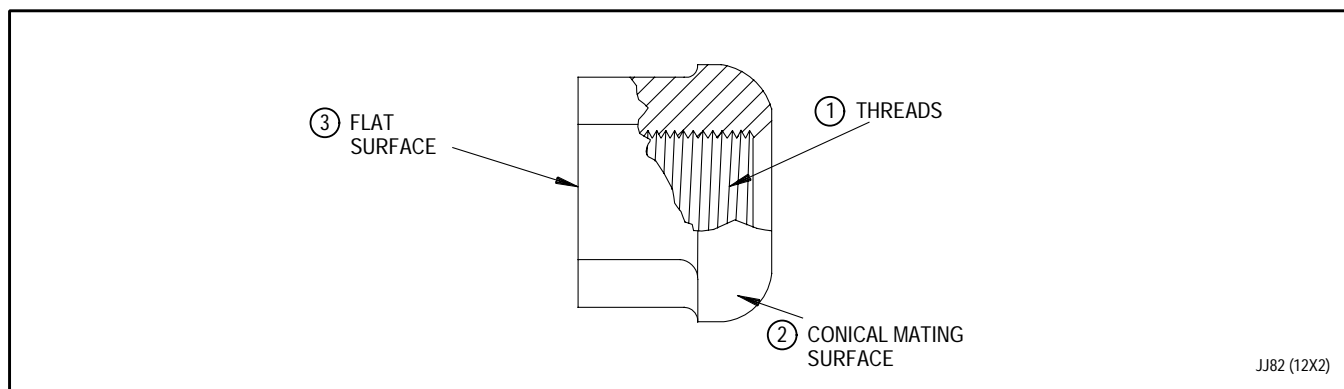
2. NO. 5 BEARING SUPPORT ROD BALL-END - INSPECTION.

(See Figure 1.)

- a. Inspect No. 5 bearing support rod ball-end. (See figure 1.)

NOTE

When inspecting contact, No. 5 bearing support rod ball-end and No. 5 bearing support ball socket seat must be mated together. Refer to T.O. 2J-F100-53-9, WP 327 00. After inspection, keep parts together in sets and identify with location.



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Threads - Damaged	Not serviceable	See corrective action.	Remove minor thread damage by removing high metal with fine abrasive stone. Replace No. 5 bearing support rod ball-end with excessive thread damage.

Figure 1. No. 5 Bearing Support Rod Ball-End - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
2. Concial mating surface -			
Damaged, wear	Not serviceable	Grooves to 0.030 inch deep, as long as 80% of contact surface is not affected.	Lap repair per T.O. 2J-F100-53-9, WP 428 00.
Chromium plating peeling or rough	Not serviceable	Not repairable	Replace No. 5 bearing support rod ball-end.
3. Flat surface -			
Grooves	0.030 inch deep	Not repairable	Replace No. 5 bearing support rod ball-end.

WP 329 00 Deleted

WORK PACKAGE

TECHNICAL PROCEDURES

SEAL ASSEMBLY, FACE, NO. 5 BEARING -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	19	2 - 7	0	8	19

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

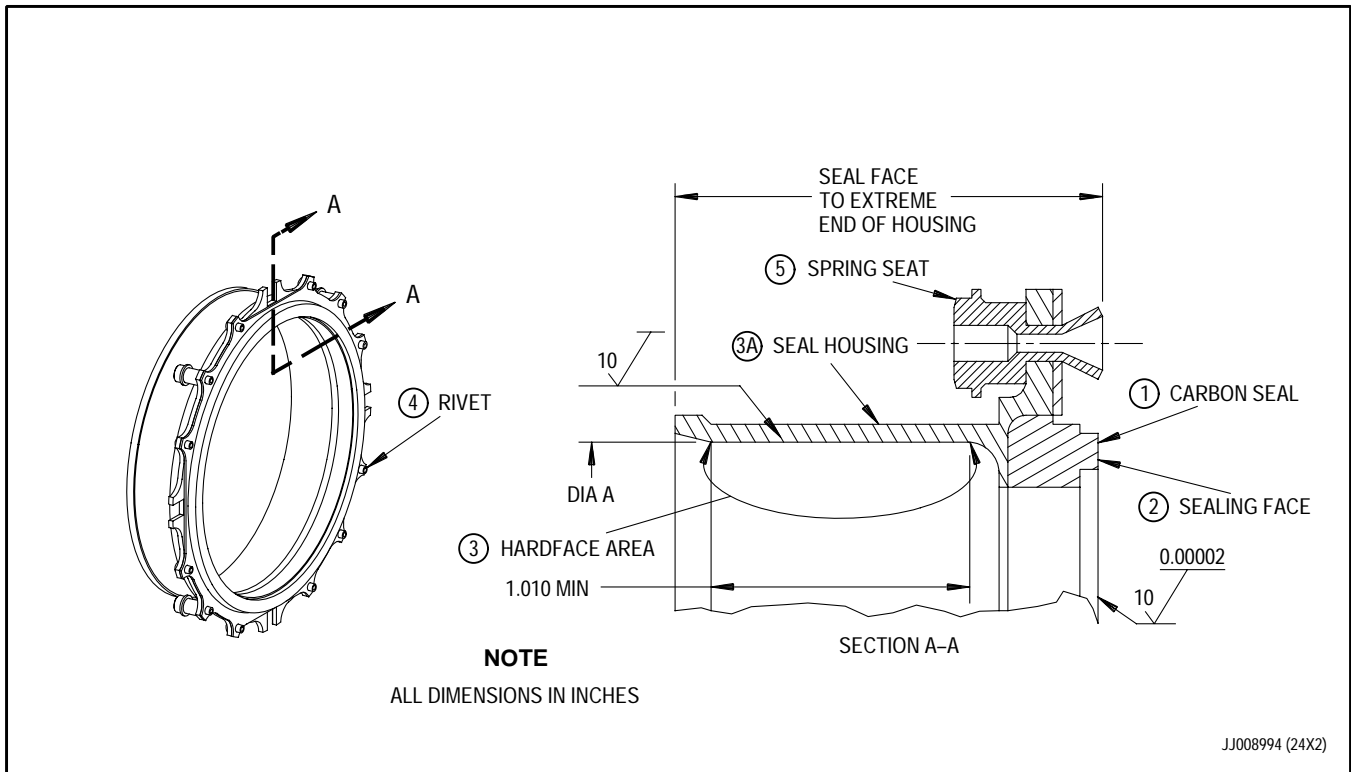
1. INTRODUCTION.

- a. This work package contains instructions for inspection of the No. 5 bearing face seal assembly.

2. NO. 5 BEARING FACE SEAL ASSEMBLY - INSPECTION.

(See Figure 1.)

- a. Inspect No. 5 bearing face seal assembly. (See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Carbon seal - Chips, nicks, scratches in nonsealing surfaces.	Acceptable provided other items of this figure are observed.	Not required	Not required

Figure 1. No. 5 Bearing Face Seal Assembly - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Carbon seal - (continued)			
Cracks	Not serviceable	Not repairable	Replace No. 5 bearing face seal assembly.
Deterioration (crumbling of carbon)	Not serviceable	Not repairable	Replace No. 5 bearing face seal assembly.
2. Sealing face (carbon seal) -			
Wear (seal face to extreme end of housing)	Refer to WP 801 00, Reference 4151.	Not repairable	Replace No. 5 bearing face seal assembly.
Chips, nicks, and scratches	A concentric circular area of not less than 60% of original width of seal face shall remain undamaged and make sealing contact with seal seat.	Lap seal to serviceable limit while maintaining seal face to extreme end of housing height in figure 1. Refer to WP 801 00, Reference 4151.	Lap repair. Refer to WP 430 00.
Scratches extending across sealing face	Acceptable provided depth does not exceed 0.005 inch and width does not exceed 0.010 inch.	Scratches larger than serviceable limit may be partially removed by lapping to serviceable limit maintaining seal face to extreme end of housing height.	Lap repair. Refer to WP 430 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
2. Sealing face (carbon seal) - (continued)			
Squareness	Sealing face must be square with Diameter A within 0.001 inch total.	See seal face to extreme end of housing limit. Refer to WP 801 00, Reference 4151.	Lap repair. Refer to WP 430 00.
Surface finish. Inspect using optical flats. Refer to T.O. 2-1-111	See figure 1.	See seal face to extreme end of housing limit. Refer to WP 801 00, Reference 4151.	Lap repair. Refer to WP 430 00.
3. Hardface area -			
Nicks, dents without burrs	Serviceable	Not required	Not required.
Nicks, dents with burrs	Not serviceable	Any amount	Lightly polish to remove protruding material.

NOTE

Do not confuse unevenness with discoloration due to oxidation.

Unevenness	Not serviceable	Not reparable	Replace No. 5 bearing face seal assembly.
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Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3. Hardface area - (continued)			
Chipped	a. 0.010 inch wide b. 0.010 inch long c. 0.400 inch maximum combined length d. Chips shall be separated by a minimum of 0.125 inch.	Not reparable	Replace No. 5 bearing face seal assembly.
Small cracks	Serviceable provided cracks do not extend into base metal.	Not reparable	Replace No. 5 bearing face seal assembly if cracks extend into base metal.
Scratches extending across sealing area	a. 0.001 inch deep b. 0.001 inch wide	See corrective action.	Polish to remove high spots. It is not necessary to remove scratches completely.
Minor pitting	Acceptable provided sealing is not affected	See corrective action.	Replace No. 5 bearing face seal assembly if sealing is affected.
Wear	Refer to WP 801 00, Reference 4137.	0.002 inch coating thickness shall remain after grinding without rehardfacing.	Replace No. 5 bearing face seal assembly if hardface wear exceeds repairable limits.
Out-of-round, Diameter A	0.002 inch out-of-round maximum in excess of tolerance	Not reparable	Replace No. 5 bearing face seal assembly.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3A. Seal housing -			
Cracks	Not serviceable	Not repairable	Replace seal assembly.
Nicks, dents or scratches (without burrs)	Serviceable	None	None
Nicks, dents or scratches (with burrs)	Not serviceable	Any amount	Remove high metal with fine file or stone. Refer to T.O. 2-1-111.
4. Rivet -			
Loose, damaged, missing	Not serviceable	See corrective action.	Replace rivet per WP 430 00.
5. Spring seat -			
Loose, damaged, missing	Not serviceable	See corrective action.	Replace No. 5 bearing face spring seat per WP 430 00.

WORK PACKAGE

TECHNICAL PROCEDURES

NUT-RETAINING, PLAIN, ROUND (NO. 5 BEARING) -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	3	18	4	0
2	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

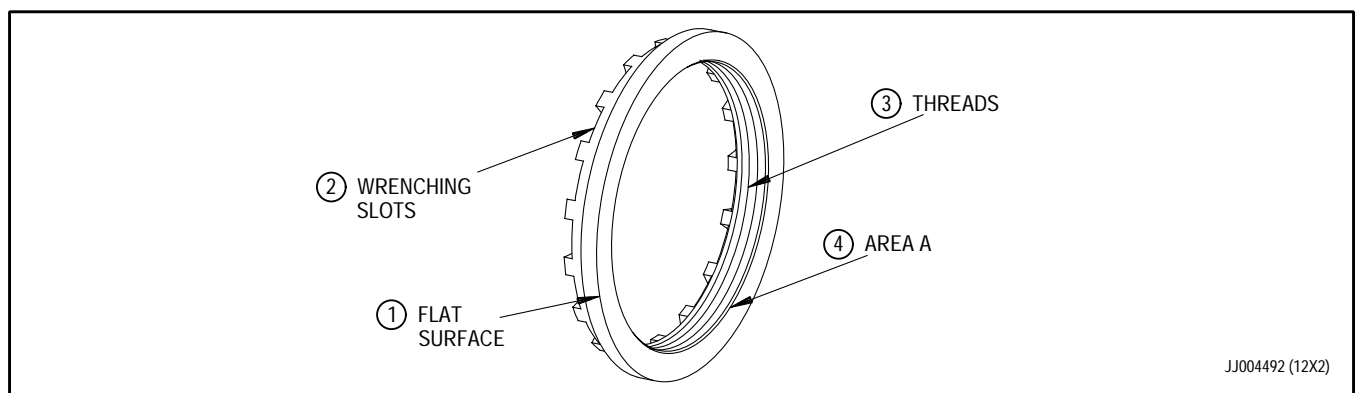
1. INTRODUCTION.

- a. This work package contains instructions for inspection of the No. 5 bearing retaining nut.

2. RETAINING NUT (NO. 5 BEARING) - INSPECTION.

(See Figure 1.)

- a. Enso. 5 bearing retaining nut has been cleaned per WP 201 00.
- b. Magnetic particle inspect retaining nut for cracks. Refer to T.O. 2J-F100-9. No cracks allowed.
- c. Perform visual inspection. (See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Flat surfaces - Burr, galling, scoring, and tool damage	Not serviceable	See corrective action.	Blend damaged areas using crocus cloth P-C-458 or fine sandpaper with nut mounted on surface plate.

Figure 1. Retaining Nut (No. 5 Bearing) - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
2. Wrenching slots -			
Damaged, tool marks	Not serviceable	See corrective action.	Remove burrs using file or fine stone.
3. Threads -			
Wear, damage	Not serviceable	All thread pickup and high metal shall be removed.	Remove high metal and pickup with fine abrasive stone.
4. Area A -			
Wear	Evidence of spinning	Not reparable	Replace nut if there is any evidence of spinning.

WORK PACKAGE

TECHNICAL PROCEDURES

BEARING-ROLLER, CYLINDRICAL, NO. 5 -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4		27			

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Depot Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Bearing, Roller, Cylindrical, No. 5 - Repair - - - - -	WP 426 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the No. 5 bearing.

2. NO. 5 BEARING - INSPECTION.

(See Figure 1 and Tables 1 and 2.)



- Do not handle bearing with bare hands. Wear clean gloves of synthetic rubber or lint-free nylon mesh. If neither one is available wear clean, lint-free, cotton gloves. Refer to T.O. 2-1-111.
- Mismatched bearing details can cause bearing failure. Serial numbers on the outer race and inner race shall match. Bearing details shall be stored as a matched set.
- Do not mark functional or nonfunctional surfaces of bearing to prevent bearing damage and stack-up deviations.

- a. Inspect No. 5 bearing per tables 1 and 2 for unserviceable distress modes (work unit codes and numbers). Refer to T.O. 2-1-111. Repair unserviceable bearing per WP 426 00.

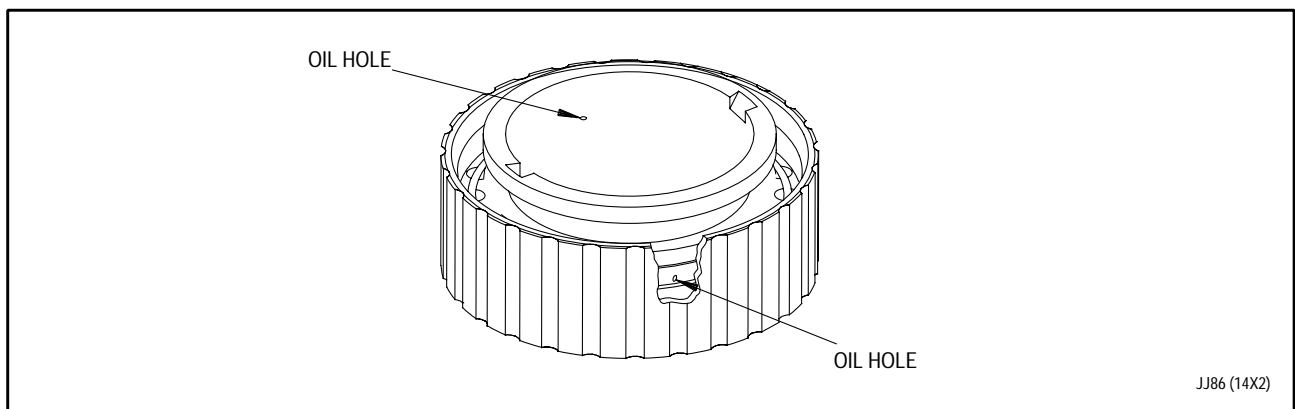
- b. Inspect oil holes in inner race to ensure they are open. Remove any obstruction.
(See figure 1.)

Table 1. No. 5 Bearing - Limits

Part No.	Internal Radial Clearance (Inches)
4066596	0.0017 0.0012 (33)
4066597	0.0017 0.0012 (33)
4066598	0.0017 0.0012 (33)
4066599	0.0017 0.0012 (33)
4082553	0.0017 0.0012 (33)

NOTE

Number in parentheses is load in pounds.



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Figure 1. No. 5 Bearing - Inspection

Table 2. No. 5 Bearing - Inspection Requirements

LCN Code	Task Code	Location	Distress Mode
EECFAJ	JGDFGAA	Outer rings	Heat discoloration
EECFAJ	JGDFGAB	Outer rings	Galling
EECFAJ	JGDFGAC	Outer rings	Brinelling
EECFAJ	JGDFGAD	Outer rings	Cracks
EECFAJ	JGDFGAE	Outer rings	Pits
EECFAJ	JGDFGAF	Outer rings	Nicks and dents
EECFAJ	JGDFGAG	Outer rings	Scratches, scuffs, and scoring
EECFAJ	JGDFGAH	Outer rings	Skidding
EECFAJ	JGDFGAJ	Outer rings	Spalling
EECFAJ	JGDFGAK	Roller	Galling
EECFAJ	JGDFGAL	Roller	Heat discoloration
EECFAJ	JGDFGAM	Roller	Brinelling
EECFAJ	JGDFGAN	Roller	Pits
EECFAJ	JGDFGAP	Roller	Nicks and dents
EECFAJ	JGDFGAQ	Roller	Scratches, scuffs, and scoring
EECFAJ	JGDFGAR	Roller	Skidding
EECFAJ	JGDFGAS	Roller	Spalling
EECFAJ	JGDFGAT	Roller	End wear
EECFAJ	JGDFGAU	Cage	Plate flaking and peeling
EECFAJ	JGDFGAV	Cage	Plate wear
EECFAJ	JGDFGAW	Cage	Out of round
EECFAJ	JGDFGAX	Cage	Cracks
EECFAJ	JGDFGAY	Rings	Outer race scoring

WORK PACKAGE

TECHNICAL PROCEDURES

SEAT - NO. 5 BEARING SEAL -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 6					0

REFERENCE MATERIAL REQUIRED

Title	Number
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Lapping of Main Bearing Carbon Seals, Seal Plates, and Spacers - - - - -	SWP 091 05
Optical Flatness Check of Main Bearing Carbon Seals, Seal Plates, and Spacers - - - - -	SWP 091 06

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Cloth, abrasive, 400 grit	Norton Co.

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the No. 5 bearing seal seat.

2. No. 5 BEARING SEAL SEAT - INSPECTION.

(See Figure 1.)

NOTE

Lap the seal seat and perform a flatness inspection whenever it will be used with a different carbon seal. Refer to T.O. 2J-F100-53-1, SWP 091 05 and SWP 091 06.

- a. Inspect No. 5 bearing seal seat.
(See figure 1.)

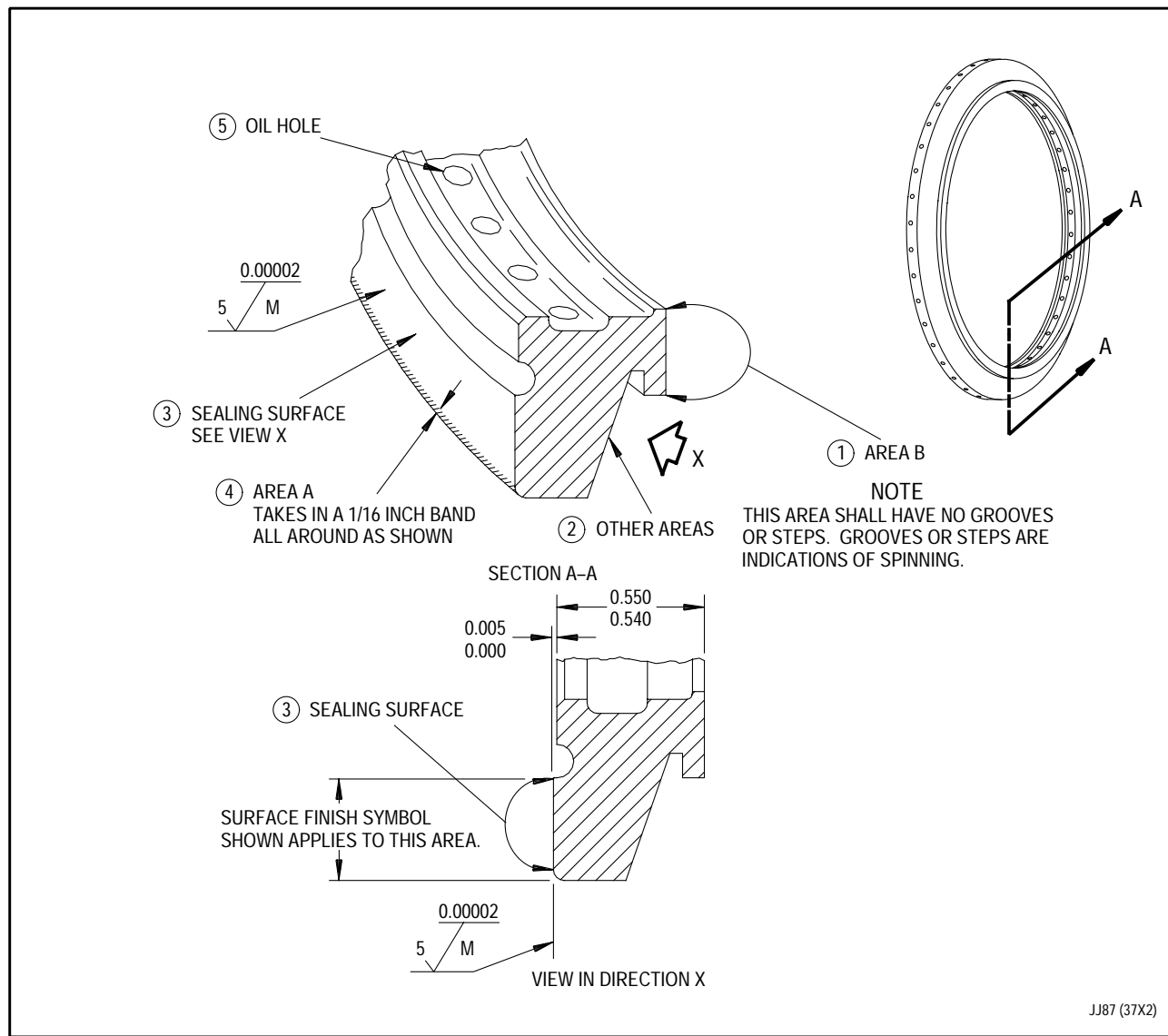


Figure 1. No. 5 Bearing Seal Seat - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Area B -			
Scored	Acceptable provided 0.540 to 0.550 inch dimension is met and there is no evidence of spinning against retaining nut.	Not repairable	Replace seal seat if there is any evidence of spinning against retaining nut.
2. Other areas -			
Nicks, dents, burrs	Not serviceable	0.030 inch deep.	Deburr/remove high metal.
3. Sealing surface -			
Pitting	a. 0.010 inch across longest dimension. b. Pits must be at least 1.000 inch apart. c. Maximum of three pits allowed.	Not repairable	Replace seal seat.
Scoring	0.003 inch provided scoring does not penetrate base material.	Not serviceable	Polish on a lap plate covered with a tightly stretched 400 grit polishing cloth to remove high spots.
Cracks	Acceptable provided crack does not extend into base material.	Not repairable	Replace seal seat with cracks in base material.
Nicks, dents without protruding material	Serviceable	Not applicable	None
Nicks, dents with protruding material	Not serviceable	Not repairable	Replace seal seat.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
3. Sealing surface - (continued)			
Scratches across sealing surface	Not serviceable	a. 0.001 inch deep b. 0.001 inch wide c. See corrective action.	Polish on a lap plate covered with a tightly stretched 400 grit polishing cloth to remove high spots. It is not necessary to remove scratches completely.
Chipped	a. 0.010 inch long b. 0.010 inch radial width c. Chips shall be separated by a minimum of 0.125 inch. d. Combined length of all chips shall not exceed 0.400 inch.	Not reparable	Replace seal seat.
NOTE			
Do not confuse unevenness with discoloration due to oxidation.			
Inspect surface finish and flatness for unevenness per T.O.2J-F100-53-1, SWP 091 06.	(See figure 1.)	Not reparable	Replace seal seat.
4. Area A -			
Chipped	Acceptable provided chipping is outside seal contact area and does not exceed 0.0625 inch depth	Not reparable	Replace seal seat.
5. Oil holes -			
Blocked	Not serviceable	Any amount	Remove obstruction.

WORK PACKAGE

TECHNICAL PROCEDURES

NUT - RETAINING, PLAIN, ROUND (NO. 5 BEARING SEAL SEAT) -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
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2	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Cloth, abrasive crocus	P-C-458

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

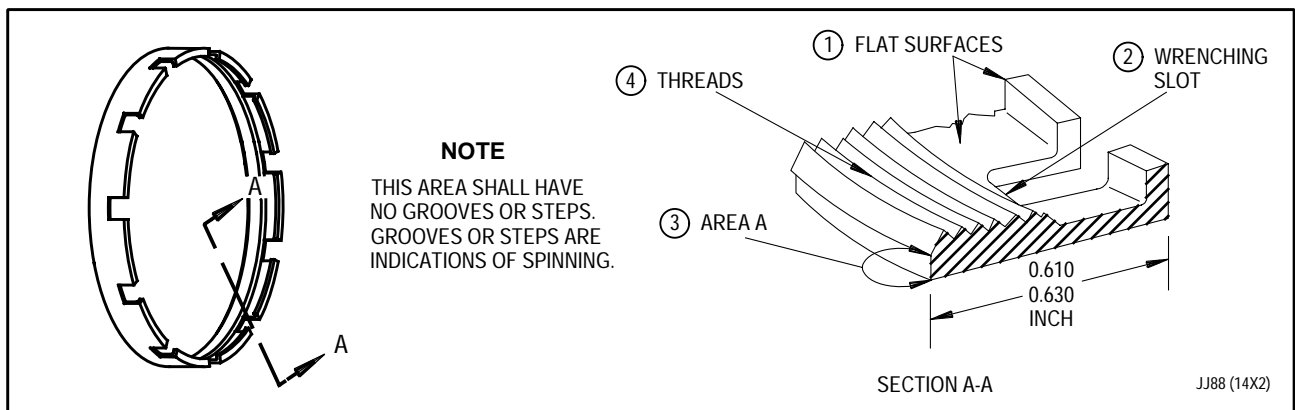
1. INTRODUCTION.

- a. This work package contains instructions for inspection of the No. 5 bearing seal seat retaining nut.

2. RETAINING NUT (NO. 5 BEARING SEAL SEAT) - INSPECTION.

(See Figure 1.)

- a. Ensure No. 5 seal seat retaining nut has been cleaned per WP 201 00.
- b. Magnetic particle inspect retaining nut for cracks. Refer to T.O. 2J-F100-9. No cracks allowed.
- c. Perform visual inspection.
(See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Flat surfaces - Burr, galling, scoring, and tool damage	Not serviceable	See corrective action.	Blend damaged areas using crocus cloth P-C-458 or fine sandpaper with nut mounted on surface plate.
2. Wrenching slots - Damaged, tool marks	Not serviceable	See corrective action.	Remove burrs using file/fine stone.

Figure 1. Retaining Nut (No. 5 Bearing Seal Seat) - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3. Area A - Wear	Acceptable provided 0.610 to 0.630 inch dimension is met and there is no evidence of spinning against seal seat	Not reparable	Replace nut if there is any evidence of spinning.
4. Threads - Wear, damage	Not serviceable	All thread pick up and high metal shall be removed.	Remove high metal and pick-up with fine abrasive stone.

WORK PACKAGE

TECHNICAL PROCEDURES

SUPPORT ASSEMBLY - NO. 5 BEARING, INNER -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	3	18	4 - 6	0
2	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

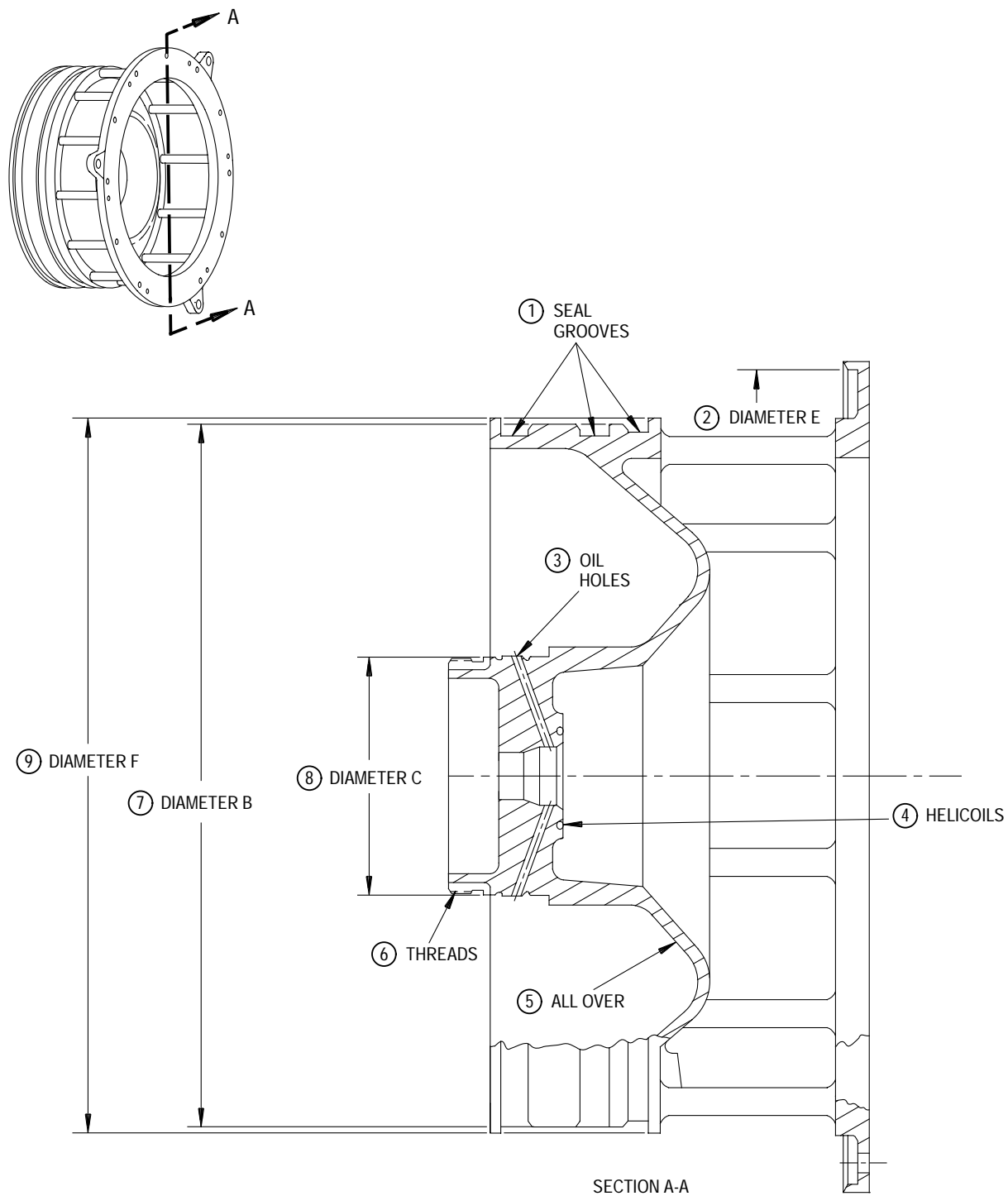
- a. This work package contains instructions for inspection of the No. 5 bearing inner support assembly.

- c. Visually inspect support for surface damage and wear with white light and 10X magnifying glass.
- d. See figure 1 for inspection limits.

2. NO. 5 BEARING INNER SUPPORT ASSEMBLY - INSPECTION.

(See Figure 1.)

- a. Ensure No. 5 bearing inner support assembly has been cleaned per WP 201 00.
- b. Fluorescent penetrant inspect No. 5 bearing inner support assembly for cracks on a system currently qualified per MIL-STD-1823 at 90 percent probability of detection and 50 percent confidence level to surface length indication of 0.070 inch long. Refer to T.O. 2J-F100-9. No cracks allowed.



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Figure 1. No. 5 Bearing Inner Support Assembly - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Seal grooves - Galling, pickup	Not serviceable	Any amount of pickup or high metal.	Blend per WP 435 00.
2. Diameter E - Wear	Per WP 801 00, Reference 4130	Not repairable	Replace bearing support assembly.
3. Oil holes - Blocked	Not serviceable	Any amount	Remove obstructions.
4. Helicoils - Loose	Not serviceable	Not repairable	Replace bearing support assembly.
5. All over - Cracks	Not serviceable	Not repairable	Replace bearing support assembly.
Nicks, dents, and scratches	Not serviceable	Blend to 0.005 inch deep maximum. Depth after blend shall not exceed 0.010 inch.	Blend repair per WP 435 00.
Porosity	0.140 inch diameter 0.040 inch deep	Not repairable.	Replace bearing support assembly.
6. Threads - Damaged	Not serviceable	All pickup and high metal shall be removed.	Blend to remove high metal and pickup per WP 435 00.

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
7. Diameter B -			
Wear	Not serviceable	Not reparable	Replace bearing support assembly.
Galling/pickup	Not serviceable	0.003 inch maximum depth	Blend repair per WP 435 00.
8. Diameter C -			
Wear	Not serviceable	Not reparable	Replace bearing support assembly.
9. Diameter F -			
Wear	Not serviceable	Not reparable	Replace bearing support assembly.

WORK PACKAGE**TECHNICAL PROCEDURES****CAP-OIL CHECK VALVE****INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3					
4 Blank					

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

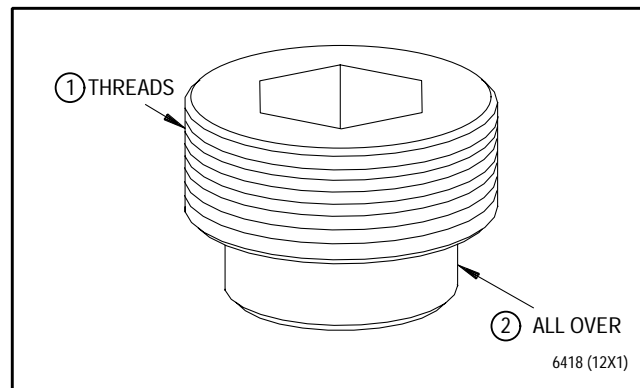
None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the oil check valve cap.

2. OIL CHECK VALVE CAP - INSPECTION.

(See Figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Threads - Damaged	Not serviceable	See corrective action.	Remove minor thread damage by removing high metal with fine abrasive stone. Replace cap with excessive thread damage. Refer to T.O. 2-1-111.
2. All over - Nicks, burrs	Not serviceable	Not repairable	Remove burrs and high metal with fine stone. Refer to T.O. 2-1-111.

Figure 1. Oil Check Valve Cap - Inspection

WORK PACKAGE

TECHNICAL PROCEDURES

VALVE, ASSEMBLY OIL CHECK

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	1
2	0
3	1
4 Blank	0

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

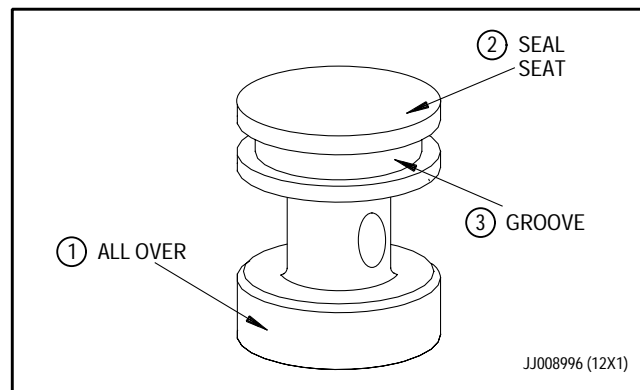
1. INTRODUCTION.

- a. This work package contains instructions for inspection of the oil check valve assembly

2. OIL CHECK VALVE ASSEMBLY - INSPECTION.

(See Figure 1.)

- a. Inspect oil check valve seat.
(See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. All over - Nick, dents, scratches	Not serviceable	See corrective action.	Remove high metal and burrs with fine stone. Refer to T.O. 2-1-111.
2. Seal seat - Scratches nicks, dents	Not serviceable	Not repairable	Replace oil check valve seat.
3. Groove - Nick, scratches	Not serviceable	0.005 deep and 0.010 wide	Remove high metal and burrs with fine stone.

Figure 1. Oil Check Valve Assembly - Inspection

WORK PACKAGE

TECHNICAL PROCEDURES

STOP-OIL CHECK VALVE

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
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4 Blank	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

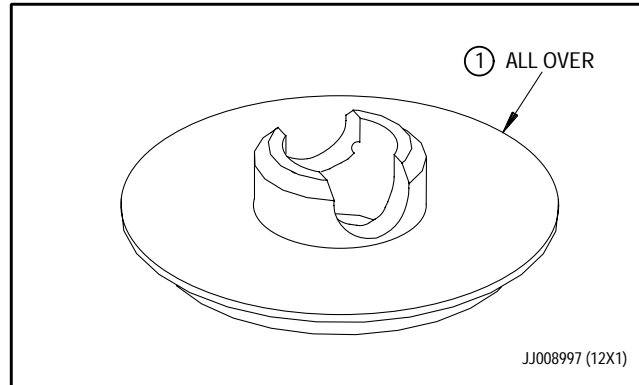
1. INTRODUCTION.

- a. This work package contains instructions for inspection of the oil check valve stop.

2. OIL CHECK VALVE STOP - INSPECTION.

(See Figure 1.)

- a. Inspect oil check valve stop.
(See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. All over Nick, dents, scratches, burrs	Not serviceable	See corrective action.	Blend with fine stone. Refer to T.O. 2-1-111.

Figure 1. Oil Check Valve Stop - Inspection

WORK PACKAGE

TECHNICAL PROCEDURES

VALVE-OIL CHECK

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	11	3	11	4 Blank	0
2	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

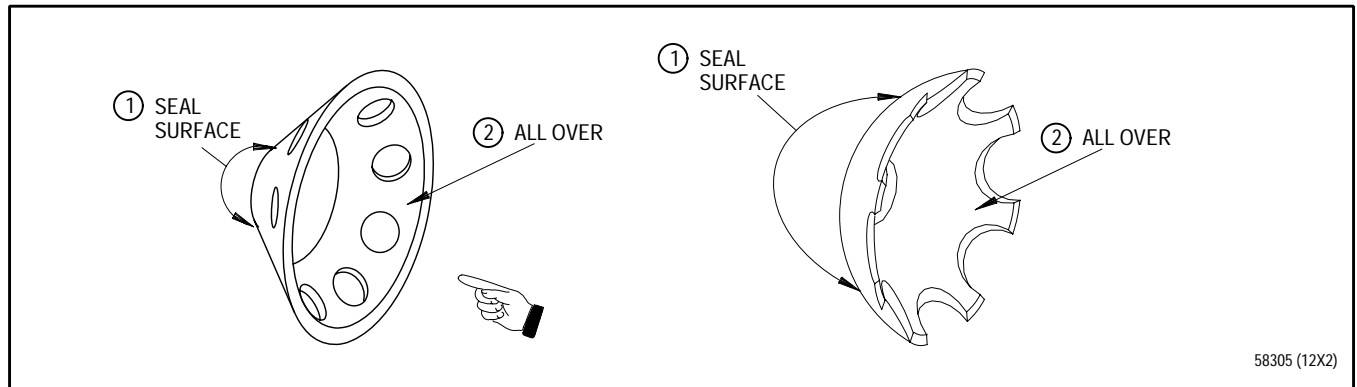
1. INTRODUCTION.

- a. This work package contains instructions for inspection of the oil check valve.

2. OIL CHECK VALVE - INSPECTION.

(See Figure 1.)

- a. Inspect oil check valve. (See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Seal surface -			
Scratches nicks, dents	Not serviceable	Not repairable	Replace oil check valve.
2. All over -			
Nicks, scratches, dents	Not serviceable	See corrective action.	Blend with fine stone. Refer to T.O. 2-1-111.
Cracks, missing material	Not serviceable	Not repairable	Replace oil check valve.

Figure 1. Oil Check Valve - Inspection

WORK PACKAGE

TECHNICAL PROCEDURES

SEAT-TURBINE SHAFT LOCK -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4	0

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the turbine shaft lock seat.

2. TURBINE SHAFT LOCK SEAT - INSPECTION.

(See Figure 1.)

- a. Inspect turbine shaft lock seat.
(See figure 1.)

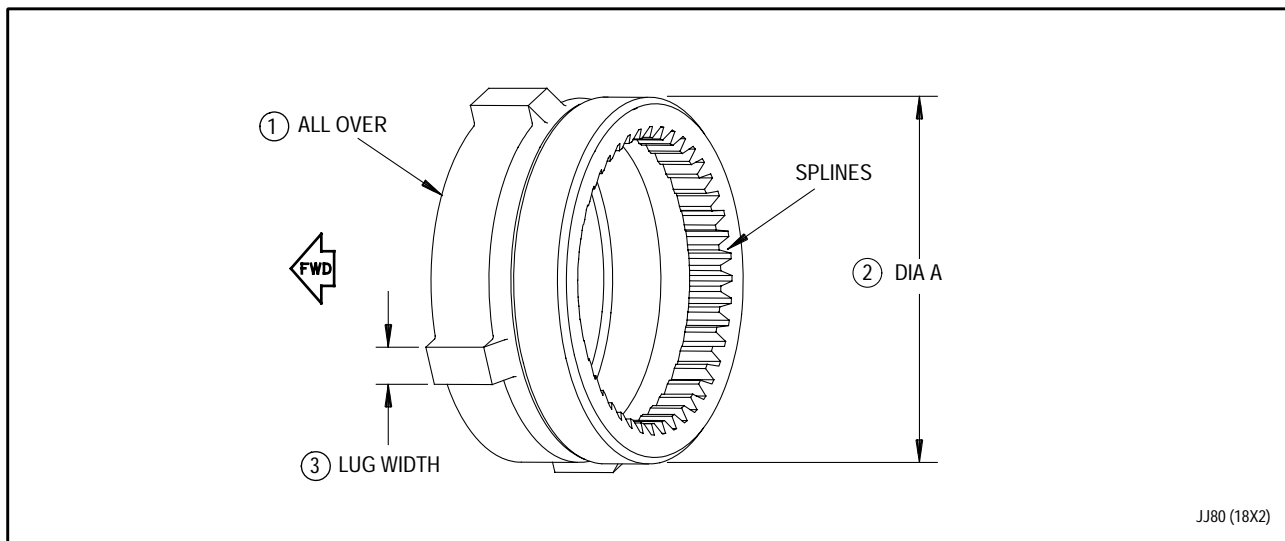


Figure 1. Turbine Shaft Lock Seat - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. All over -			
Pits, nicks, dents	a. 0.030 inch deep by 0.125 inch diameter at any two locations except splines and Diameter A.	See corrective action.	Remove raised metal and pickup with fine stone. Blend. Refer to T.O. 2J-F100-53-9, WP 440 00.
	b. 0.015 inch deep by 0.015 inch diameter at any location.		
	All damage shall be separated by 0.250 inch minimum.		
Scratches	0.015 inch deep	See corrective action.	Remove raised metal and pickup with fine stone.
2. Diameter A -			
Wear	2.2460 inch minimum diameter	2.2435 inch minimum diameter	Hold pending availability of repair procedures.
3. Lug width -			
Wear	0.245 inch minimum width	Not reparable	Replace seat.

WORK PACKAGE

TECHNICAL PROCEDURES

FRONT DUCT ASSEMBLY, TURBINE EXHAUST -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	3	18	4	0
2	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection and repair of turbine exhaust duct (front) assembly.

2. TURBINE EXHAUST DUCT (FRONT) ASSEMBLY - INSPECTION.

(See Figure 1.)

- a. Ensure turbine exhaust duct (front) assembly has been cleaned per WP 201 00.
- b. Fluorescent penetrant inspect turbine exhaust duct (front) assembly for cracks. Refer to T.O. 2J-F100-9. No cracks allowed.
- c. Perform visual inspection.
(See figure 1.)

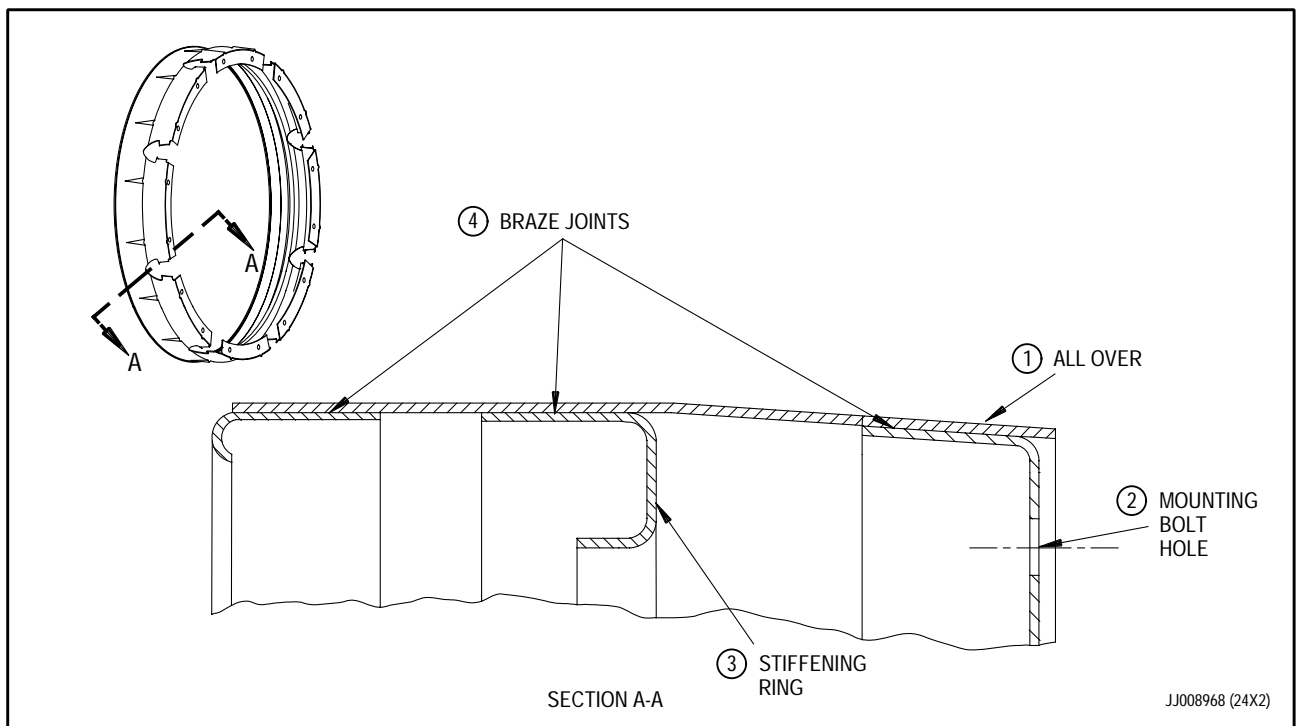


Figure 1. Turbine Exhaust Duct (Front) Assembly - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Reparable Limits	Corrective Action
1. All over -			
Nicks and scratches (without adjacent cracks)	Any number, each up to 0.007 inch deep, provided high metal is blended	See corrective action.	Replace turbine exhaust duct assembly.
Dents (without adjacent cracks)	Any number each up to 0.125 inch deep, round bottom, and 2 inch diameter	Up to 3 inches wide, 5 inches long and 0.500 inch depth	Hammer and smooth out dents that exceed serviceable limits.
Cracks	Not serviceable	Not reparable	Replace turbine exhaust duct assembly.
2. Mounting bolt hole -			
Bolthole ovalization	Up to 0.275 inch maximum diameter with no less than 0.150 inch edge distance.	Not reparable	Replace turbine exhaust duct assembly.
3. Stiffening ring -			
Cracks	Not serviceable	Not reparable	Replace turbine exhaust duct assembly.
Looseness	Not serviceable	Not reparable	Replace turbine exhaust duct assembly.
4. Braze joints -			
Looseness	Not serviceable	Not reparable	Replace turbine exhaust duct assembly.

WORK PACKAGE

TECHNICAL PROCEDURES

REAR DUCT ASSEMBLY, TURBINE EXHAUST -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	3 - 5	28	6	0
2	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Compound antigalling (PWA 36035)	Fel-Pro C-300

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection and repair of turbine exhaust duct (rear) assembly.

2. TURBINE EXHAUST DUCT (REAR) ASSEMBLY - INSPECTION.

(See Figure 1.)

- a. Ensure turbine exhaust duct (rear) assembly has been cleaned per WP 201 00.
- b. Fluorescent penetrant inspect turbine exhaust duct (rear) assembly for cracks. Refer to T.O. 2J-F100-9. No cracks allowed.
- c. Perform visual inspection.
(See figure 1.)

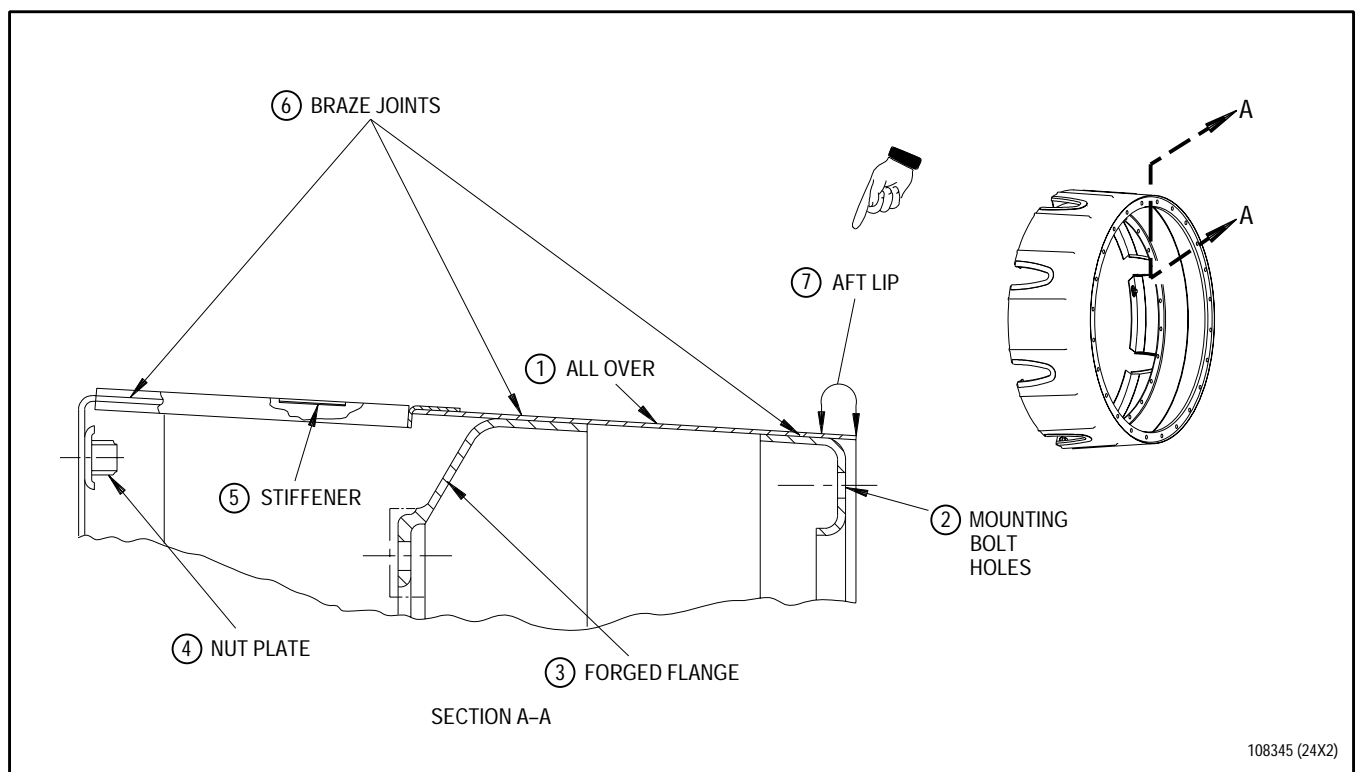


Figure 1. Turbine Exhaust Duct (Rear) Assembly - Inspection

Legend for figure 1

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. All over -			
Nicks and scratches (without adjacent cracks)	Any number, each up to 0.007 inch deep, provided high metal is blended	Not repairable	Replace turbine exhaust duct assembly.
Dents (without adjacent cracks)	Any number each up to 0.125 inch deep, round bottom, and 2 inch diameter	Up to 3 inches wide, 5 inches long and 0.500 inch deep	Hammer and smooth out dents that exceed serviceable limits.
Cracks	Not serviceable	Not repairable	Replace turbine exhaust duct assembly.
2. Mounting bolt holes -			
Bolthole ovalization	Up to 0.275 inch maximum diameter with no less than 0.150 inch edge distance.	Not repairable	Replace turbine exhaust duct assembly.
3. Forged flange			
Cracks	Not serviceable	Not repairable	Replace turbine exhaust duct assembly.
4. Nut plate -			
Nicks, dents, and saw marks	0.020 inch	See corrective action.	Replace nutplate per WP 442 00.
Loose, missing	Not serviceable	See corrective action.	Replace nutplate per WP 442 00.
Worn threads	See paragraph 3.		

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
5. Stiffener -			
Cracks	Not serviceable	Not repairable	Replace turbine exhaust duct assembly.
Looseness	Not serviceable	Not repairable	Replace turbine exhaust duct assembly.
6. Braze joints -			
Looseness	Not serviceable	Not repairable	Replace turbine exhaust duct assembly.
7. Aft lip -			
Damage	Not serviceable	See corrective action.	Blend repair per WP 442 00.

3. REAR FAIRING NUTPLATE - INSPECTION.

a. Inspect rear fairing nutplate locking feature as follows:

(1) Brush thin coating Fel-Pro C-300 antigalling compound on thread and washer face of MS969609 bolt. Do not use bolt with stripped or damaged threads.

(2) Thread bolt into nutplate by hand. If bolt can be threaded past the locking feature with moderate finger torque the nutplate is not acceptable, and go to step b. Continue at seven other locations, using freshly coated bolts.

(3) If step a.(2) is acceptable, measure friction torque with bolt in steady clockwise rotation. If torque exceeds 25 pound-inches prior to seating, the nutplate is not acceptable and go to step b.

b. If nutplate is not acceptable, replace nutplate per WP 442 00.

WORK PACKAGE**TECHNICAL PROCEDURES****STIFFENERS, TURBINE SHAFT - INSPECTION****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 5					
6 Blank					

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

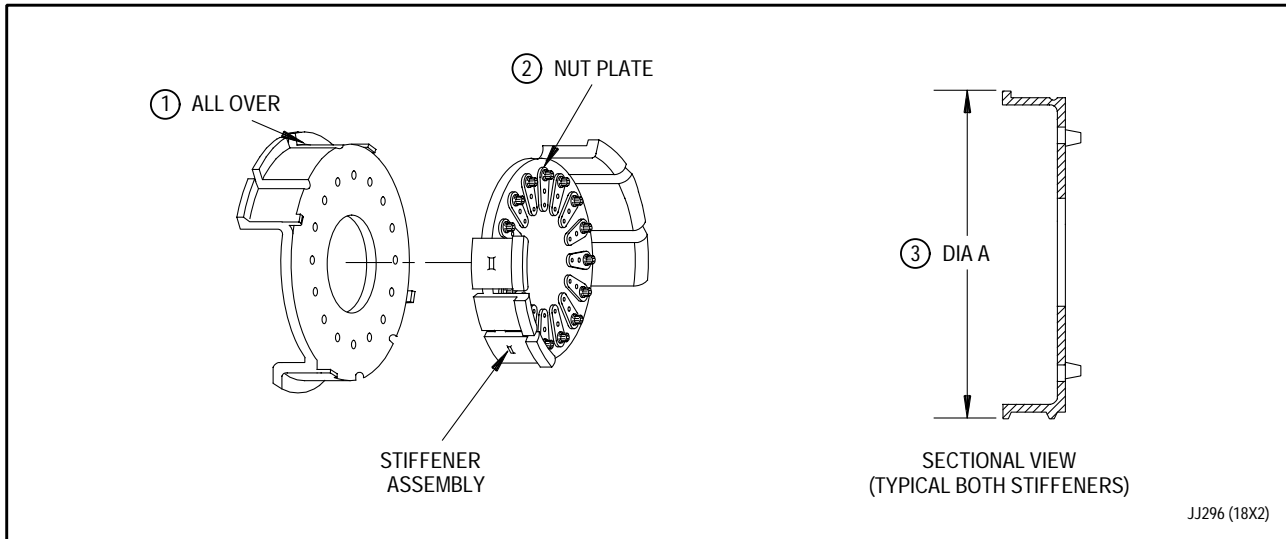
- a. This work package contains instructions for the inspection of the front compressor drive turbine shaft stiffeners.

2. FRONT COMPRESSOR DRIVE TURBINE SHAFT STIFFENERS - INSPECTION.

(See Figure 1.)

- a. Inspect front compressor drive turbine shaft stiffeners.

(See figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. All over -			
Nicks, Pits, and dents	a. 0.010 inch depth and 0.031 inch diameter in 6 locations. b. 1 nick, dent, or pit permitted up to 0.062 inch diameter.	See corrective action.	Blend repair. Refer to WP 443 00.
Scratches	0.005 inch depth	See corrective action	Blend repair. Refer to WP 443 00.
Cracks	None permissible	Not repairable	Replace stiffener.

Figure 1. Front Compressor Drive Turbine Shaft Stiffeners - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
2. Nut plate -			
Adequate torque of self-locking nut	a. 13.0 pound-inches maximum locking torque.	See corrective action.	Replace nut plate.
	b. 2.0 pound-inches minimum break-away torque.		
3. Diameter A -			
Wear	5.142 inch diameter	See corrective action.	Nickel plate repair. Refer to WP 443 00

WORK PACKAGE

TECHNICAL PROCEDURES

SHIELD, HEAT, FRONT COMPRESSOR DRIVESHAFT -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 5	0				
6 Blank	0				

REFERENCE MATERIAL REQUIRED

Title	Number
General Maintenance Procedures - - - - -	T.O. 2-1-111

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

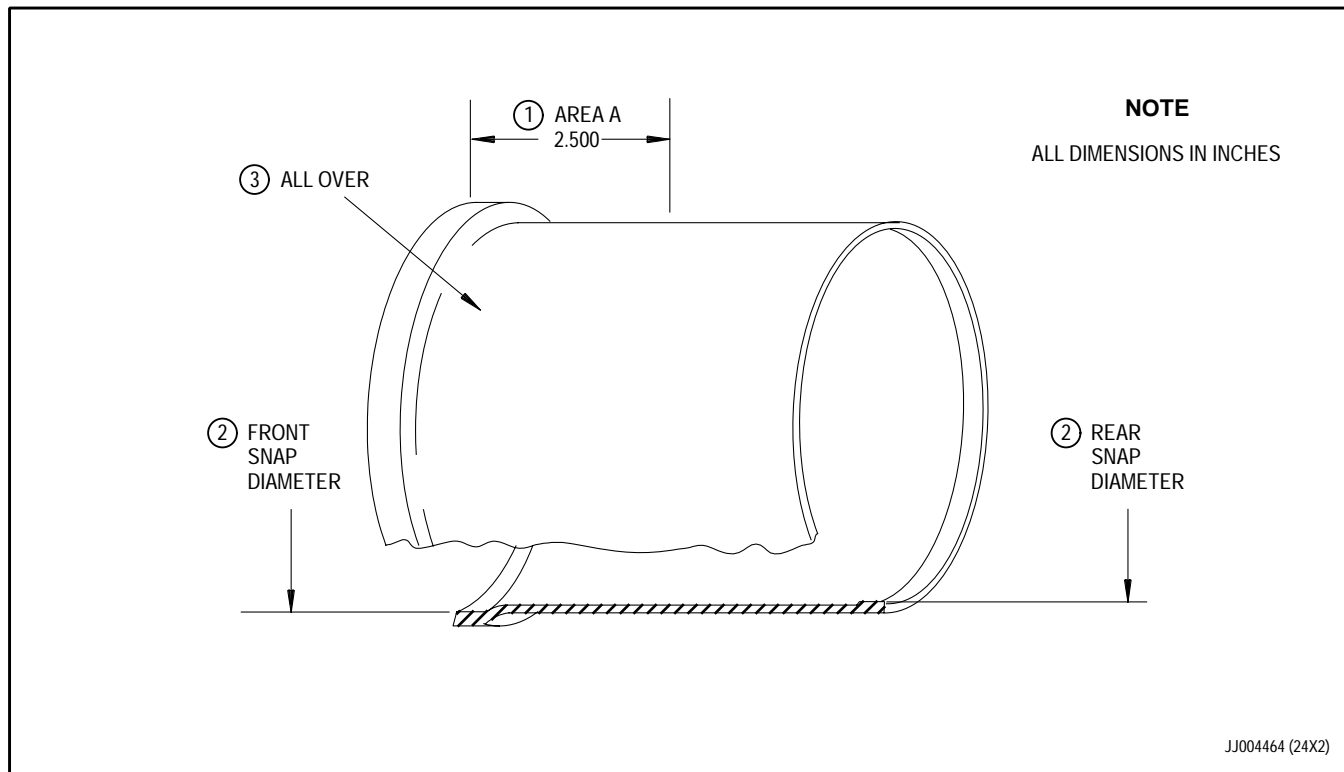
None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the front compressor driveshaft heat shield.

2. FRONT COMPRESSOR DRIVESHAFT HEAT SHIELD - INSPECTION.

(See Figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Area A -			
Discoloration (blue)	Serviceable	-	-
2. Front and rear ID snap diameters -			
Damage	0.005 inch in depth	Not repairable	Replace heat shield.
Cracks	Not serviceable	Not repairable	Replace heat shield.

Figure 1. Front Compressor Driveshaft Heat Shield - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3. All over except snap diameters -			
Cracks	Not serviceable	Not repairable	Replace heat shield.
Nicks and dents	a. 0.020 inch in depth, 0.200 inch maximum diameter, at one location. b. 0.020 inch in depth, 0.100 inch maximum diameter, up to 4 locations. c. All separated by 0.250 inch.	Not repairable	Replace heat shield.
Scratches	0.015 inch in depth and separated from other damage by 0.250 inch	Not repairable	Replace heat shield.

NOTE

After inspection apply antigalling compound. Refer to T.O. 2-1-111.

WORK PACKAGE

TECHNICAL PROCEDURES

PLUG, NO. 5 BEARING - INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	4	18	5	0
2 - 3	0			6 Blank	0

REFERENCE MATERIAL REQUIRED

Title	Number
General Maintenance Procedures - - - - -	T.O. 2-1-111
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Plug No. 5 Bearing - Repair - - - - -	WP 445 00
Fan Drive Turbine Module Table of Limits and Clearance	
Charts - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

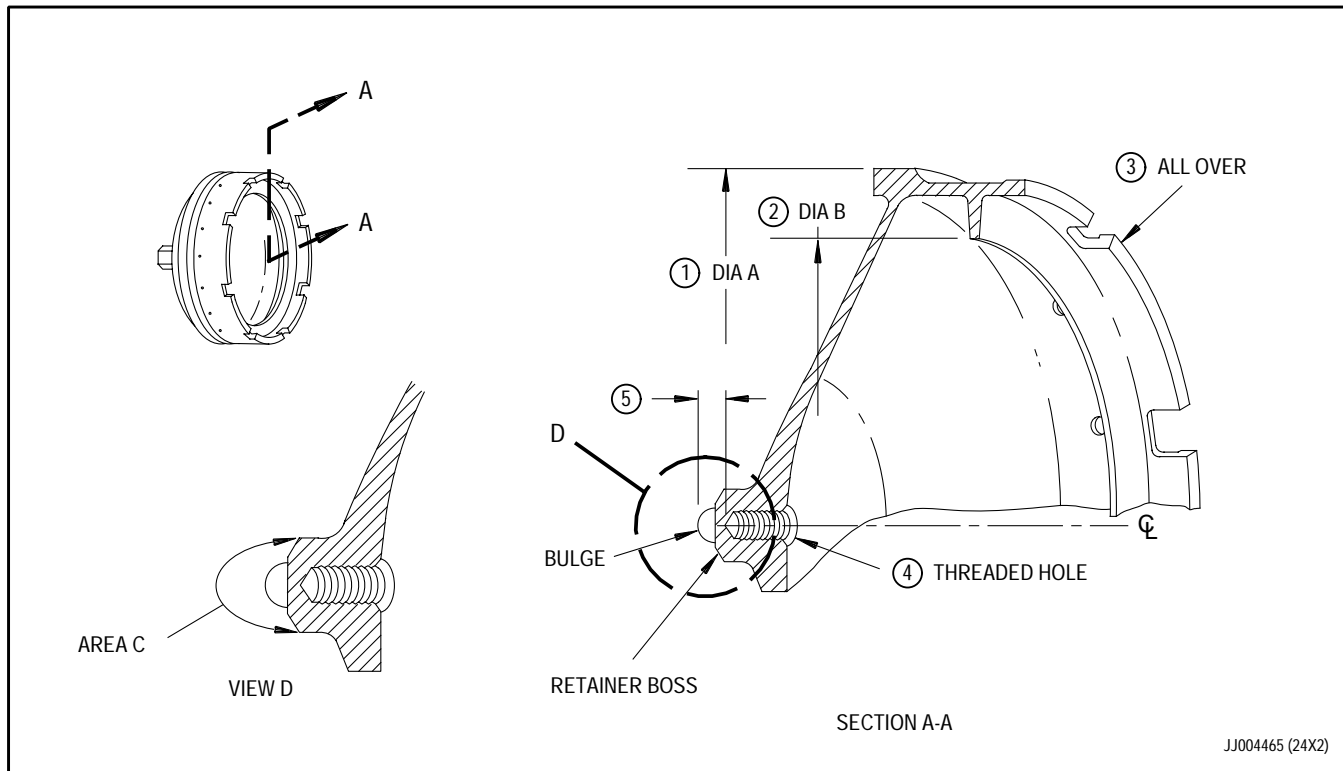
- a. This work package contains instructions for the inspection of the No. 5 bearing plug.

2. NO. 5 BEARING PLUG - INSPECTION.

(See Figure 1.)

- a. Ensure No. 5 bearing plug has been cleaned per WP 201 00.

- b. Fluorescent penetrant inspect Area C of No. 5 bearing plug for cracks. Refer to T.O. 2J-F100-9. No cracks allowed.



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. Diameter A - Wear	Per WP 801 00, Reference 4127.	See corrective action.	Replace plug.
2. Diameter B - Wear	4.040 inches	4.160 inches	Plug repair per WP 445 00.

Figure 1. No. 5 Bearing Plug - Inspection

Legend for figure 1 (continued)

Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
3. All over, except Diameters A and B and threaded hole -			
Nicks and scratches	0.005 inch deep maximum with no cracks or raised metal	0.010 inch deep maximum with no cracks	Blend repair per WP 445 00.
4. Threaded hole -			
Damaged threads	Not serviceable	Reparable if thread damage can be removed.	Thread repair per WP 445 00.
5. Retainer boss			
Bulging	If bulging exists, check for 0.020 inch minimum wall thickness and cracks using fluorescent penetrant inspection. Refer to SPOP 62 in T.O. 2-1-111. No cracks allowed.	Not reparable	Replace plug.

WORK PACKAGE

TECHNICAL PROCEDURES

RING RETAINING THIRD STAGE TURBINE STATOR -

INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	0				
4 Blank	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

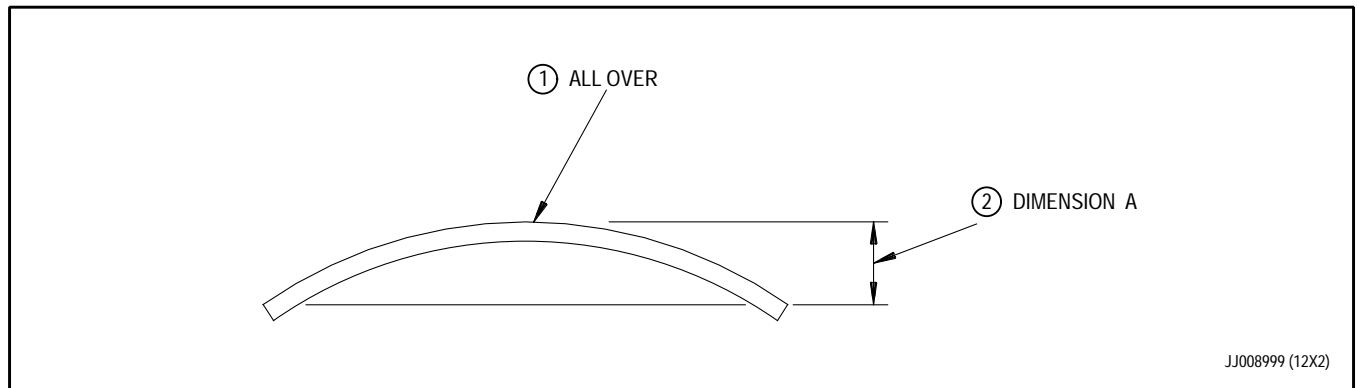
None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 3rd stage turbine stator retaining ring.

2. THIRD STAGE TURBINE STATOR RETAINING RING - INSPECTION.

(See Figure 1.)



Inspection Area - Condition	Maximum Serviceable Limits	Maximum Repairable Limits	Corrective Action
1. All over -			
Cracks	None allowed	Not repairable	Replace segment.
Wear	0.010 inch deep	Not repairable	Replace segment.
2. Dimension A -			
Distortion			
PN 4073488 (long)	Add 2.512 inch maximum	Not repairable	Replace segment.
PN 4073489 (short)	Add 1.827 inch maximum	Not repairable	Replace segment.

Figure 1. Third Stage Turbine Stator Retaining Ring - Inspection

WP 347 00 Deleted

WORK PACKAGE

TECHNICAL PROCEDURES

NO. 5 BEARING HEAT SHIELD SPACER - INSPECTION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	18	3	18	4 Blank	0
2	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

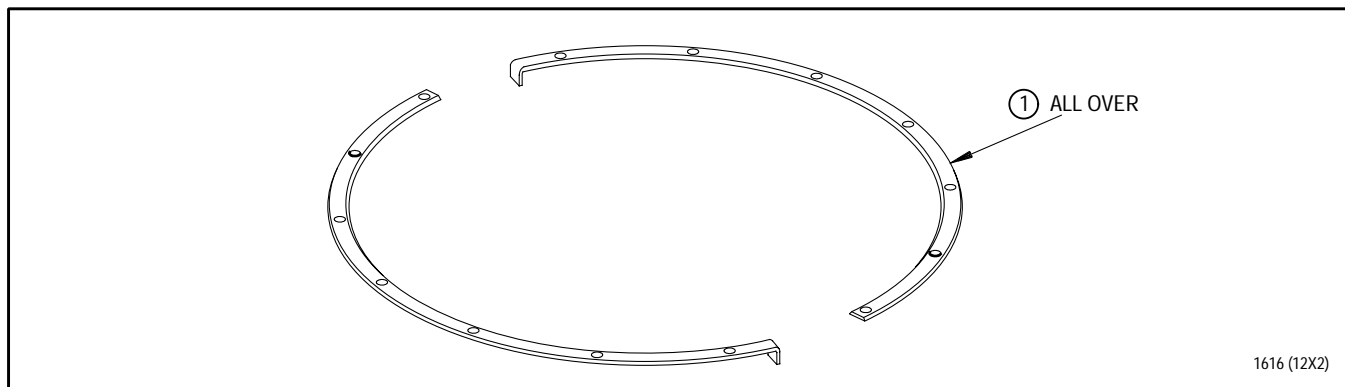
None

1. INTRODUCTION.

- a. This work package contains instructions for the inspection of the No. 5 bearing heat shield spacer.

2. NO. 5 BEARING HEAT SHIELD SPACER - INSPECTION.

- a. Ensure No. 5 bearing heat shield spacer has been cleaned per WP 201 00.
- b. Fluorescent penetrant inspect No. 5 bearing heat shield spacer for cracks. Refer to T.O. 2J-F100-9. No cracks allowed.



1616 (12X2)

Inspection Area - Condition

1. All over -
Cracks
Nicks, Dents,
Scratches

Maximum Serviceable Limits

Not serviceable
Not serviceable

Maximum Repairable Limits

Not repairable
See corrective
action.

Corrective Action

Replace part.
Remove raised metal
with fine stone.

Figure 1. No. 5 Heat Shield Spacer

WORK PACKAGE

INTRODUCTION

FAN DRIVE TURBINE MODULE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	27	4 Blank	0		

1. INTRODUCTION

- a. This work package introduces the 400 00 through 599 00 series of work packages for the fan drive turbine module. This series provides repair information. The following work packages are included in this series:

WP No.	Title
401 00	Nut, Compressor Driveshaft, Front - Repair
402 00	Shaft - Front Compressor Drive, Turbine - Repair
403 00	Ring Segment, Assembly, Air Sealing, Turbine, Third Stage - Repair
404 00	Case Assembly - Turbine, Rear and Support and Duct Set - Turbine, Rear - Repair
405 00	Ring Assembly - Air Sealing, Turbine, Third Stage - Repair
406 00	Vane - Turbine Stator, Third Stage - Repair
407 00	Vane - Turbine Stator, Fourth Stage - Repair
408 00	Ring Assembly - Air Sealing, Turbine, Third Stage (Inner) - Repair
409 00	Ring Assembly - Air Sealing, Turbine, Fourth Stage - Repair
410 00	Air Seal, Turbine, Third and Fourth Stages - Repair
411 00	Open
412 00	Disk - Turbine, Third Stage - Repair
413 00	Blade, Turbine Rotor, Third Stage - Repair
414 00	Blade, Turbine Rotor, Fourth Stage - Repair
415 00	Open
through 416 00	
417 00	Hub Assembly, Turbine Rear - Repair
418 00	Ring Assembly - Air Sealing, Turbine, Fourth Stage - Repair
419 00	Support - Turbine Air Sealing Ring, Fourth Stage - Repair
420 00	Open
421 00	Ring Segment, Assembly, Air Sealing, Turbine, Fourth Stage - Repair
422 00	Disk - Turbine, Fourth Stage - Repair

WP No.	Title
423 00	Open
424 00	Case - Assembly of, Turbine Exhaust - Repair
425 00	Seal - Assembly of, No. 5 Bearing - Repair
426 00	Bearing - Roller, Cylindrical, No. 5 - Repair
427 00	Open
428 00	Ball-End - Rod, No. 5 Bearing Support - Repair
429 00	Open
430 00	Seal Assembly, Face, No. 5 Bearing - Repair
431 00	Open
through 434 00	
435 00	Support Assembly - No. 5 Bearing, Inner - Repair
436 00	Open
through 439 00	
440 00	Seat - Turbine Shaft Lock - Repair
441 00	Open
442 00	Rear Duct Assembly, Turbine Exhaust - Repair
443 00	Stiffeners, Turbine Shaft, Front Compressor Drive - Repair
444 00	Open
445 00	Plug, No. 5 Bearing - Repair
446 00	Open
through 499 00	

WORK PACKAGE**TECHNICAL PROCEDURES****NUT, COMPRESSOR DRIVESHAFT, FRONT - REPAIR****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	0				
4 Blank	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Cleaning Wet Abrasive Blast (SPOP 9) - - - - -	SWP 031 19
General Repair Procedures - Compound Antigalling (PWA 36545) Application (SPOP 748) - - - - -	SWP 098 07

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Compound, antigalling (PWA 36545)	Everlube 382

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the front compressor driveshaft nut.

2. FRONT COMPRESSOR DRIVESHAFT NUT - ANTIGALLING COMPOUND APPLICATION.

(See Figure 1.)

- a. Wet abrasive blast area to be treated. Refer to T.O. 2J-F100-53-1, SWP 031 19 (SPOP 9).
- b. Apply PWA 36545 antigalling compound. (See Figure 1.) Refer to T.O. 2J-F100-53-1, SWP 098 07 (SPOP 748).

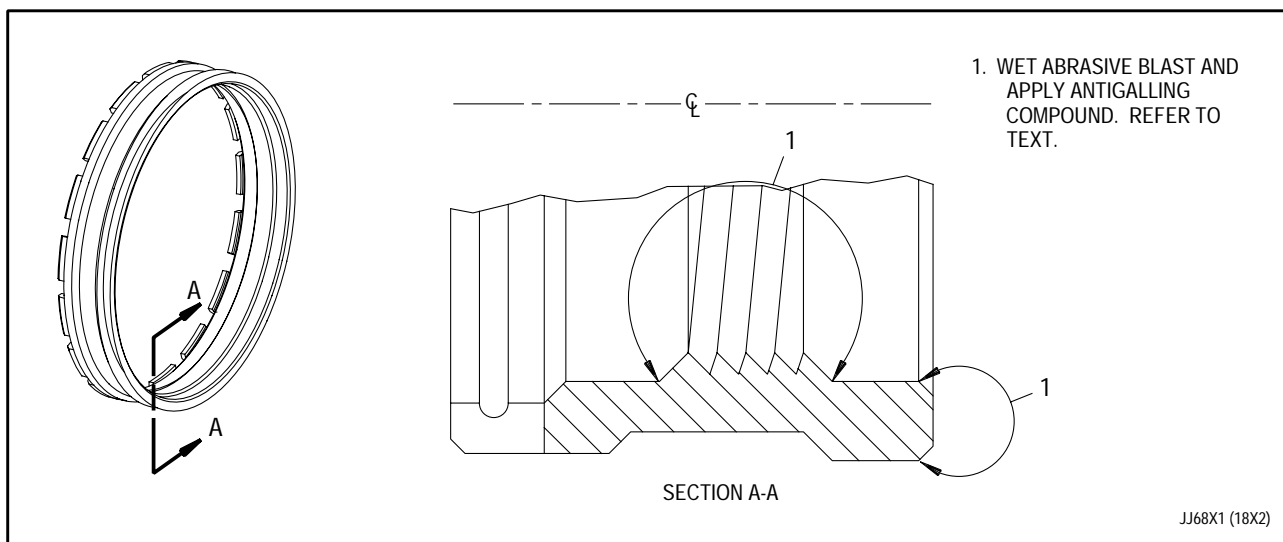


Figure 1. Front Compressor Driveshaft Nut - Antigalling Compound Application

WORK PACKAGE

TECHNICAL PROCEDURES

SHAFT - FRONT COMPRESSOR DRIVE, TURBINE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 36

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	7	3	0	5 - 35	0
2	2	4	7	36	2

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Cleaning, Glass Bead Blast, Wet (SPOP 16) - - - - -	SWP 031 03
Cleaning, Wet Abrasive Blast (SPOP 9) - - - - -	SWP 031 19
Plating, Chromium, On Steel, Nickel or Cobalt (SPOP 22) - - -	SWP 092 06
Plating, Nickel, On Steel, (Not Stainless) (SPOP 29) - - - - -	SWP 092 11
Painting, SermeTel W (PWA 110-2) (SPOP 147 and 162) - - - - -	SWP 097 03
Compound, Antigalling (PWA 36545) Application (SPOP 748) - -	SWP 098 07

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Coating, aluminum	Alseal 518 PWA 492
Coating, aluminum, inorganic	SermeTel W PWA 595
Compound, antigalling (PWA 36545)	Everlube 382 or Kaylube No. 3

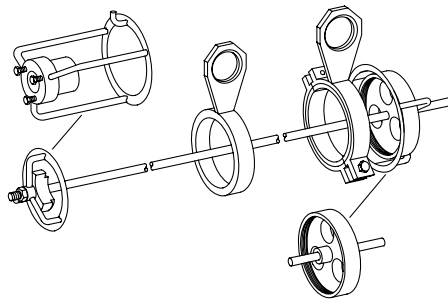
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
1	Front Compressor Drive Turbine Shaft - Plating Repair	
	Fixture, Plating - - - - -	PWA 52941

ILLUSTRATED SUPPORT EQUIPMENT



PWA 52941 -C
PWA 52941 -C

Figure T1. PWA 52941 Fixture

1. INTRODUCTION.

- a. This work package contains instructions for repair of the front compressor drive turbine shaft assembly.

2. FRONT COMPRESSOR DRIVE TURBINE SHAFT - BLEND REPAIR.

(See Figure 1.)

- a. Blending requirements are as follows (See figure 1.):
 - (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable pits, nicks, dents, scratches, and thread damage as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal and pickup to forward and rear ID threads, OD threads and rearward OD threads, and splines.
 - (3) Forward ID threads may be blended one full thread circumference, or multiple partial threads for total combined length of 7 3/8 inches.

- (4) Rear ID threads may be blended one full thread circumference, or multiple partial threads for total combined length of 15.5 inches.

- (5) Forward OD threads may be blended one full thread circumference or multiple partial threads for a combined length of 17.375 inches. Threads should then be inspected by threading on nut. Nut should travel to full engagement by hand tightening.

- (6) Rear OD thread may be blended one full thread circumference or multiple partial threads for a combined length of 16.750 inches. Threads should then be inspected by threading on nut. Nut should travel to full engagement by hand tightening.

- c. All blending repairs shall be fluorescent penetrant inspected to ensure cracks are not present. Refer to T.O. 2J-F100-9.

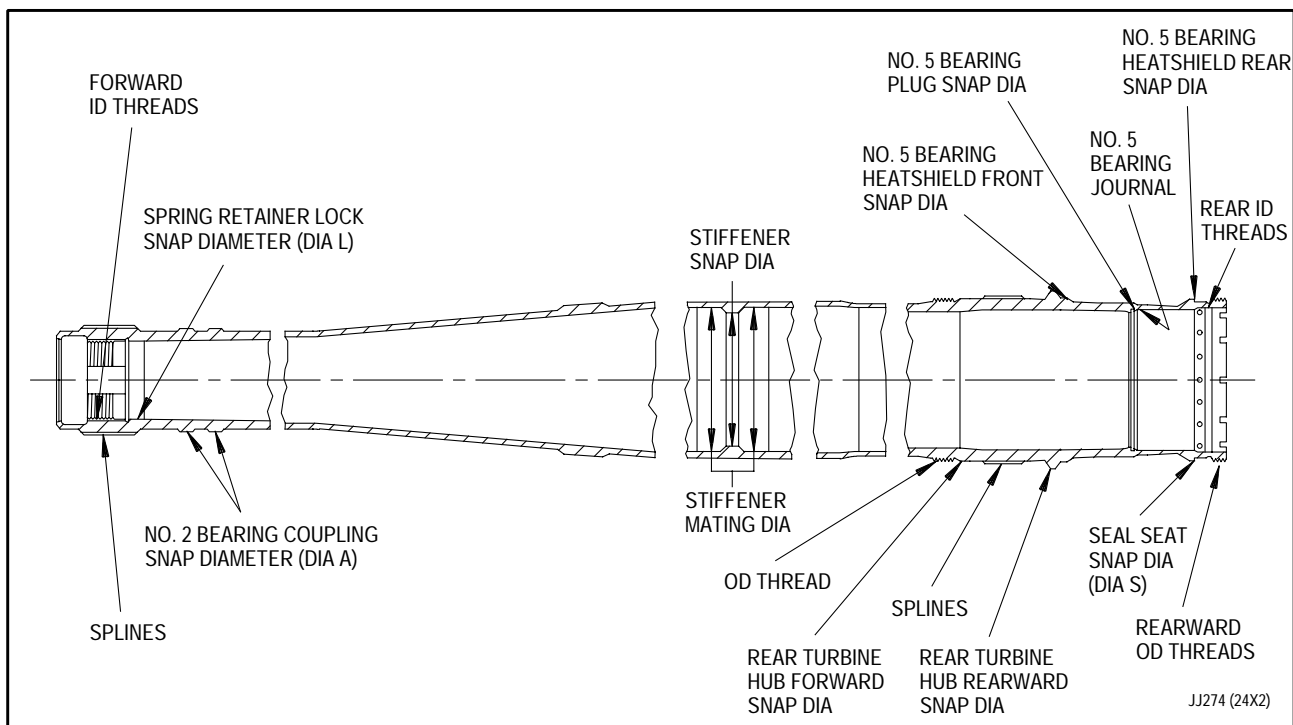


Figure 1. Front Compressor Drive Turbine Shaft - Blend Repair

**3. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - PWA 52941 PLATING FIXTURE
INSTALLATION.**

(See Figure 2.)

NOTE

This fixture is used to hold front compressor drive turbine shaft during various chromium and nickel plating repairs.

a. For nickel plating, install fixture details as follows:

- (1) Loosen cap screw(9, figure 2) and install hanger(10) over large end of shaft(4) to engage shaft on 5.270 inch diameter surface. Secure by tightening cap screw(9).
- (2) Install cathode(5) over front (small) end of shaft until it engages 4° 55' tapered OD, 20.300 inches from front end.
- (3) Thread assembled nut(7) and anode(8) on rear of shaft until it bottoms.
- (4) Back off cap screw(6).
- (5) Install assembled anode(1), locator(2) and anode(3) into small end of shaft until anode(1) protrudes through hole in anode(8) and locator(2) bottoms on front end of shaft.

(6) Secure by tightening cap screw(6).

(7) For plating operations, lift shaft using cathode(5) and hanger(10).

b. For chromium plating, install fixture details as follows:

- (1) Loosen cap screw(9) and install hanger(10) over large end of shaft to engage shaft on 5.270 inch diameter surface. Secure by tightening cap screw(9).
- (2) Install cathode(5) over front (small) end of shaft until it engages 4° 55' tapered OD, 20.300 inches from front end.
- (3) Thread assembled nut(7) and anode(11) on large end of shaft until it bottoms.
- (4) Thread assembled anode(12) and holder(13) into front end of shaft until it bottoms.
- (5) For plating operations, lift shaft using cathode(5) and hanger(10).

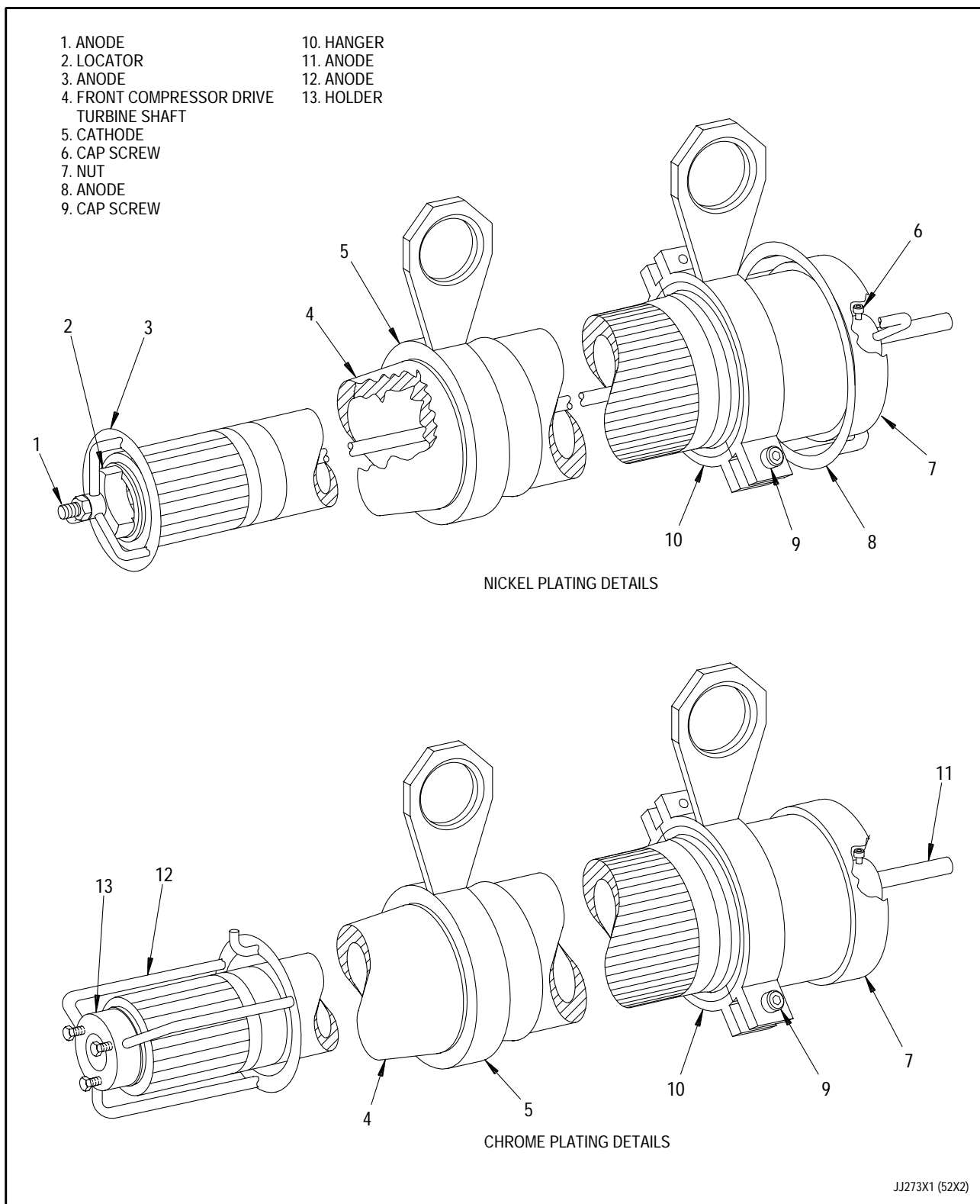


Figure 2. Front Compressor Drive Turbine Shaft - PWA 52941 Plating Fixture Installation

**4. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - SPRING LOCK RETAINER SNAP
DIAMETER REPAIR.**

(See Figure 3.)

- a. Clean up machine worn diameter to dimension(4, figure 3).
- b. Install PWA 52941 fixture.
Refer to paragraph 3.
- c. Nickel plate area(3) to dimension(4). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated area to dimensions(4, 5, 6, and 7).
- f. Ensure final dimension(4) is not exceeded.

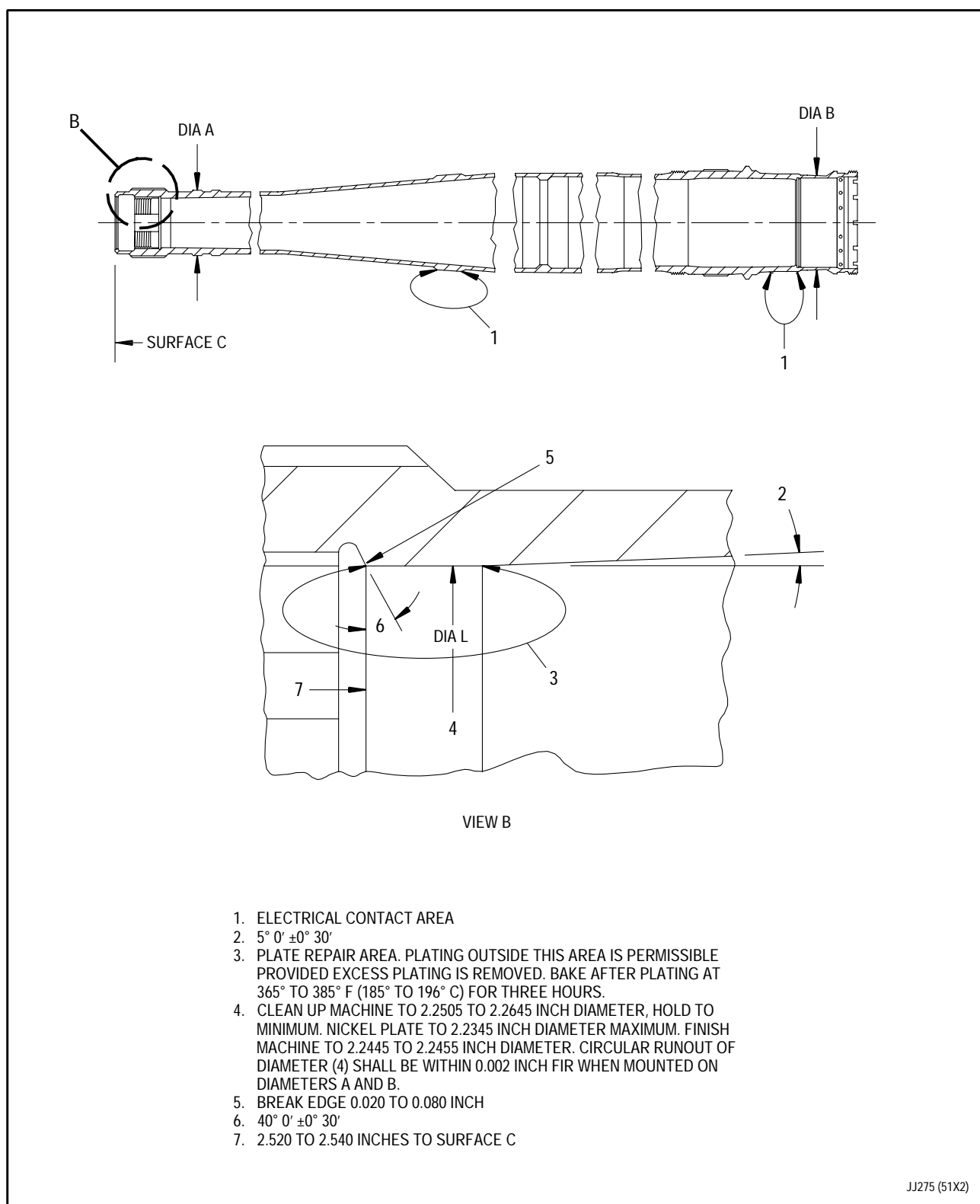
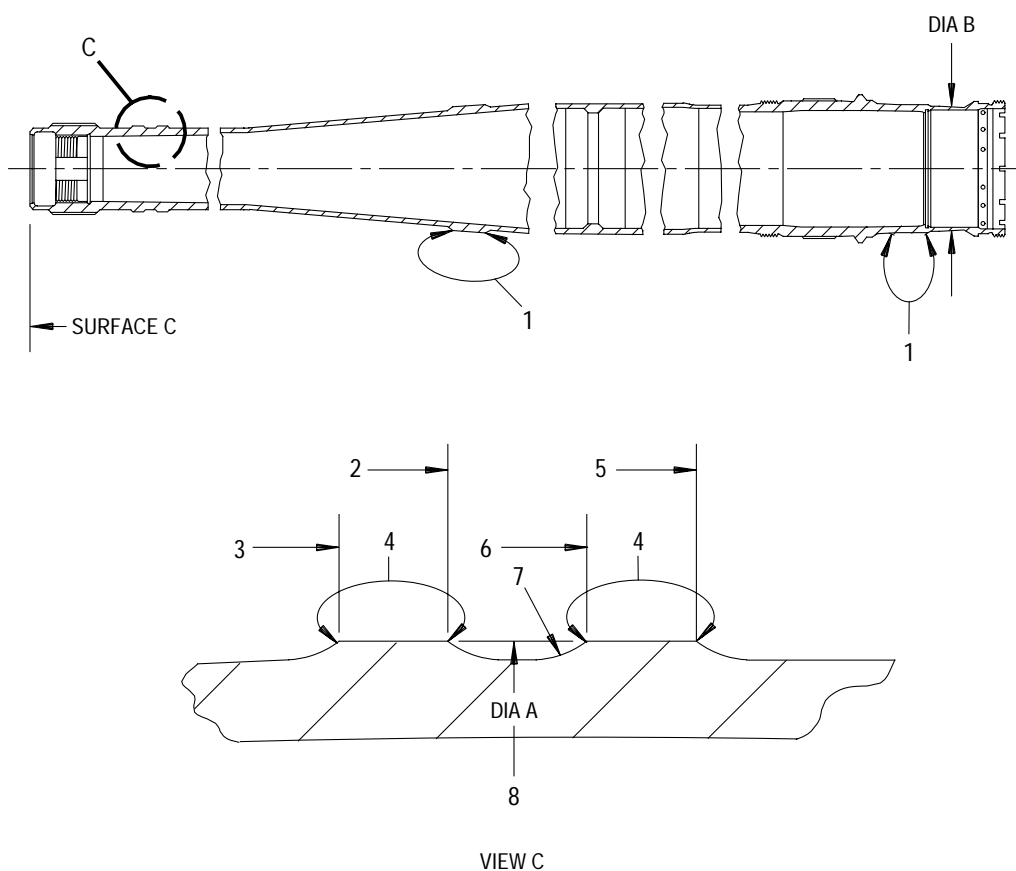


Figure 3. Front Compressor Drive Turbine Shaft - Spring Lock Retainer Snap Diameter Repair

**5. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - NO. 2 BEARING COUPLING ASSEMBLY
REAR SNAP DIAMETER REPAIR.**

(See Figure 4.)

- a. Clean up machine worn diameter to dimension(8, figure 4).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. If shotpeen option is chosen, refer to AMS 2430 with intensity equivalent to 6A.
- d. Chromium plate Diameter A in Area(4) to dimension(8). Refer to T.O. 2J-F100-53-1, SWP 092 06 (SPOP 22).
- e. Remove fixture from shaft.
- f. If shaft was not shotpeened, bake after plating at 725° to 775°F (385° to 413°C) for two hours. If shaft was shotpeened (step c.), bake at 350° to 400°F (177° to 204°C) for three hours.
- g. Finish machine plated areas to dimensions(2, 3, 5, 6, and 8).
- h. Ensure final dimension(8) is not exceeded.



1. ELECTRICAL CONTACT AREA
2. 5.040 TO 5.080 INCHES TO SURFACE C
3. 4.700 TO 4.740 INCHES TO SURFACE C
4. PLATE REPAIR AREA. PLATING OUTSIDE THIS AREA IS PERMISSIBLE PROVIDED EXCESS PLATING IS REMOVED.
5. 6.060 TO 6.100 INCHES TO SURFACE C
6. 5.770 TO 5.810 INCHES TO SURFACE C
7. 0.234 TO 0.266 INCH RADIUS, 4 PLACES
8. DIAMETER A. CLEAN UP MACHINE TO 3.4882 TO 3.4947 INCH DIAMETER, HOLD TO MAXIMUM. CHROMIUM PLATE TO 3.5102 INCH DIAMETER. FINISH MACHINE TO 3.4997 TO 3.5002 INCH DIAMETER. CIRCULAR RUNOUT SHALL BE WITHIN 0.0005 INCH FIR WHEN MOUNTED ON DIAMETERS A AND B.

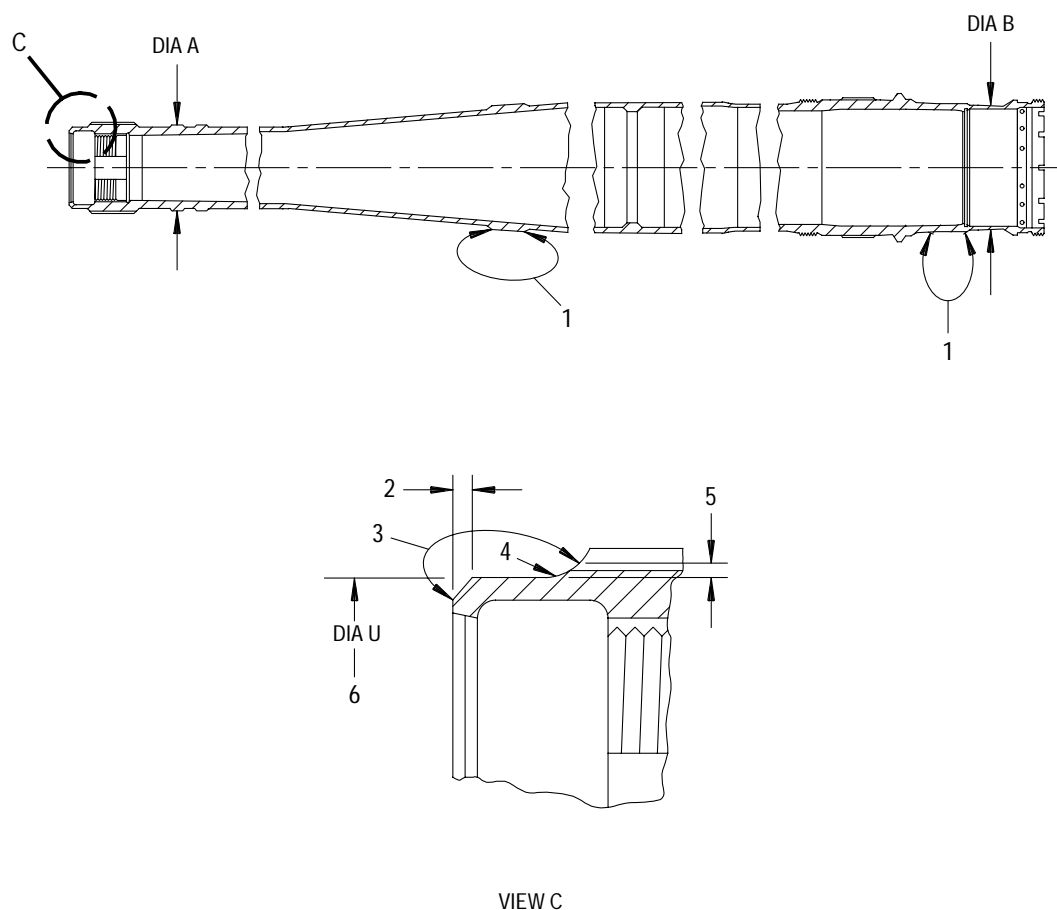
JJ276 (51X2)

**Figure 4. Front Compressor Drive Turbine Shaft -
No. 2 Bearing Coupling Assembly Rear Snap Diameter Repair**

**6. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - NO. 2 BEARING COUPLING ASSEMBLY
FRONT SNAP DIAMETER REPAIR.**

(See Figure 5.)

- a. Clean up machine worn diameter to dimension(6, figure 5).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. Nickel plate area(3) to dimension(6). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated areas to dimensions(2, 4, and 6).
- f. Ensure final dimension(6) is not exceeded.



1. ELECTRICAL CONTACT AREA
2. CHAMFER 0.080 TO 0.100 INCH X $45^\circ \pm 2^\circ$
3. PLATE REPAIR AREA. PLATING OUTSIDE THIS AREA IS PERMISSIBLE PROVIDED EXCESS PLATING IS REMOVED. BAKE AFTER PLATING 365° TO 385° F (185° TO 196° C) FOR THREE HOURS.
4. 0.234 TO 0.266 INCH RADIUS
5. 0.020 TO 0.035 INCH
6. DIAMETER U. CLEAN UP MACHINE TO 3.1301 TO 3.1446 INCH DIAMETER, HOLD TO MAXIMUM. NICKEL PLATE TO 3.1601 INCH DIAMETER. FINISH MACHINE TO 3.1496 TO 3.1501 INCH DIAMETER. CIRCULAR RUNOUT SHALL BE WITHIN 0.0005 INCH WHEN MOUNTED ON DIAMETERS A AND B.

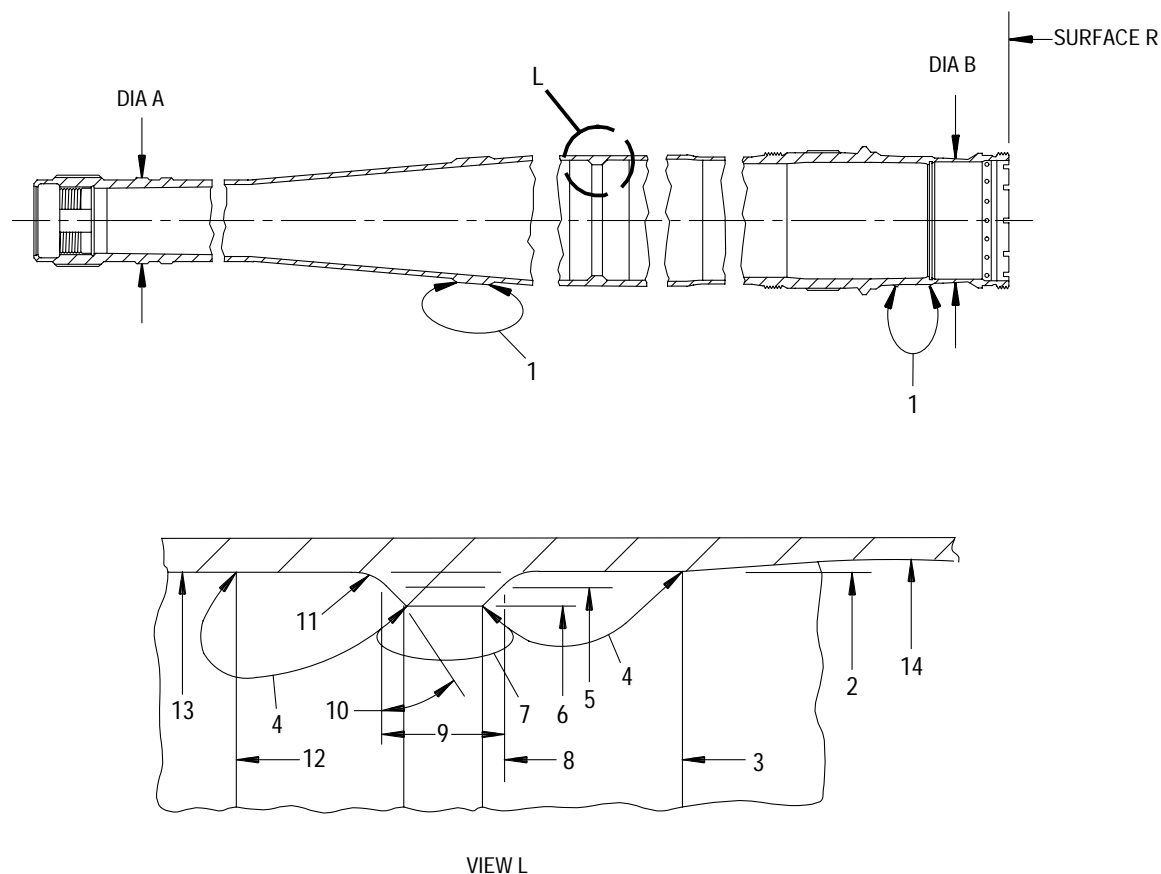
JJ277 (51X2)

**Figure 5. Front Compressor Drive Turbine Shaft -
No. 2 Bearing Coupling Assembly Front Snap Diameter Repair**

**7. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - STIFFENER SNAP DIAMETER AND
MATING DIAMETERS REPAIR.**

(See Figure 6.)

- a. Clean up machine worn diameters to dimensions(2 and 6, figure 6).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. Nickel plate areas(4 and 7) to dimensions(2 and 6). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated areas to dimensions(2, 3, 6, 8, 9, 10, 11, and 12).
- f. Ensure final dimensions(2 and 6) are not exceeded.



1. ELECTRICAL CONTACT AREA
2. CLEAN UP MACHINE TO 5.141 TO 5.156 INCH DIAMETER, HOLD TO MINIMUM. NICKEL PLATE TO 5.118 INCH DIAMETER. FINISH MACHINE TO 5.128 TO 5.136 INCH DIAMETER. CIRCULAR RUNOUT SHALL BE WITHIN 0.004 INCH FIR WHEN MOUNTED ON DIAMETERS A AND B.
3. 26.975 TO 27.475 INCHES TO SURFACE R
4. STIFFENER MATING SURFACE PLATE REPAIR AREA. PLATING OUTSIDE THIS AREA IS PERMISSIBLE PROVIDED EXCESS PLATING IS REMOVED. BAKE AFTER PLATING 365° TO 385° F (185° TO 196° C) FOR THREE HOURS.
5. 5.070 INCH DIAMETER, BASIC
6. CLEAN UP MACHINE TO 5.007 TO 5.020 INCH DIAMETER, HOLD TO MINIMUM. NICKEL PLATE TO 4.988 INCH DIAMETER. FINISH MACHINE TO 4.998 TO 5.002 INCH DIAMETER. CIRCULAR RUNOUT SHALL BE WITHIN 0.004 INCH FIR WHEN MOUNTED ON DIAMETERS A AND B.
7. STIFFENER SNAP DIAMETER PLATE REPAIR AREA. PLATING OUTSIDE THIS AREA IS PERMISSIBLE PROVIDED EXCESS PLATING IS REMOVED. BAKE AFTER PLATING 365° TO 385° F (185° TO 196° C) FOR THREE HOURS.
8. 28.325 TO 28.525 INCHES TO SURFACE R
9. 0.350 TO 0.370 INCH
10. 30° ±0° 30', 2 PLACES
11. 0.030 TO 0.040 INCH RADIUS, 2 PLACES
12. 29.745 TO 30.245 INCHES TO SURFACE R
13. 4.000 TO 8.000 INCH RADIUS
14. 2.469 TO 2.531 INCH RADIUS

JJ278 (51X2)

**Figure 6. Front Compressor Drive Turbine Shaft -
Stiffener Snap Diameter and Mating Diameters Repair**

**8. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - REAR TURBINE HUB FORWARD SNAP
DIAMETER REPAIR.**

(See Figure 7.)

- a. Clean up machine worn diameter to dimension(2, figure 7).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. Nickel plate area(6) to dimension(2). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated area to dimensions(2, 3, 5, and 8).
- f. Ensure final dimension(2) is not exceeded.

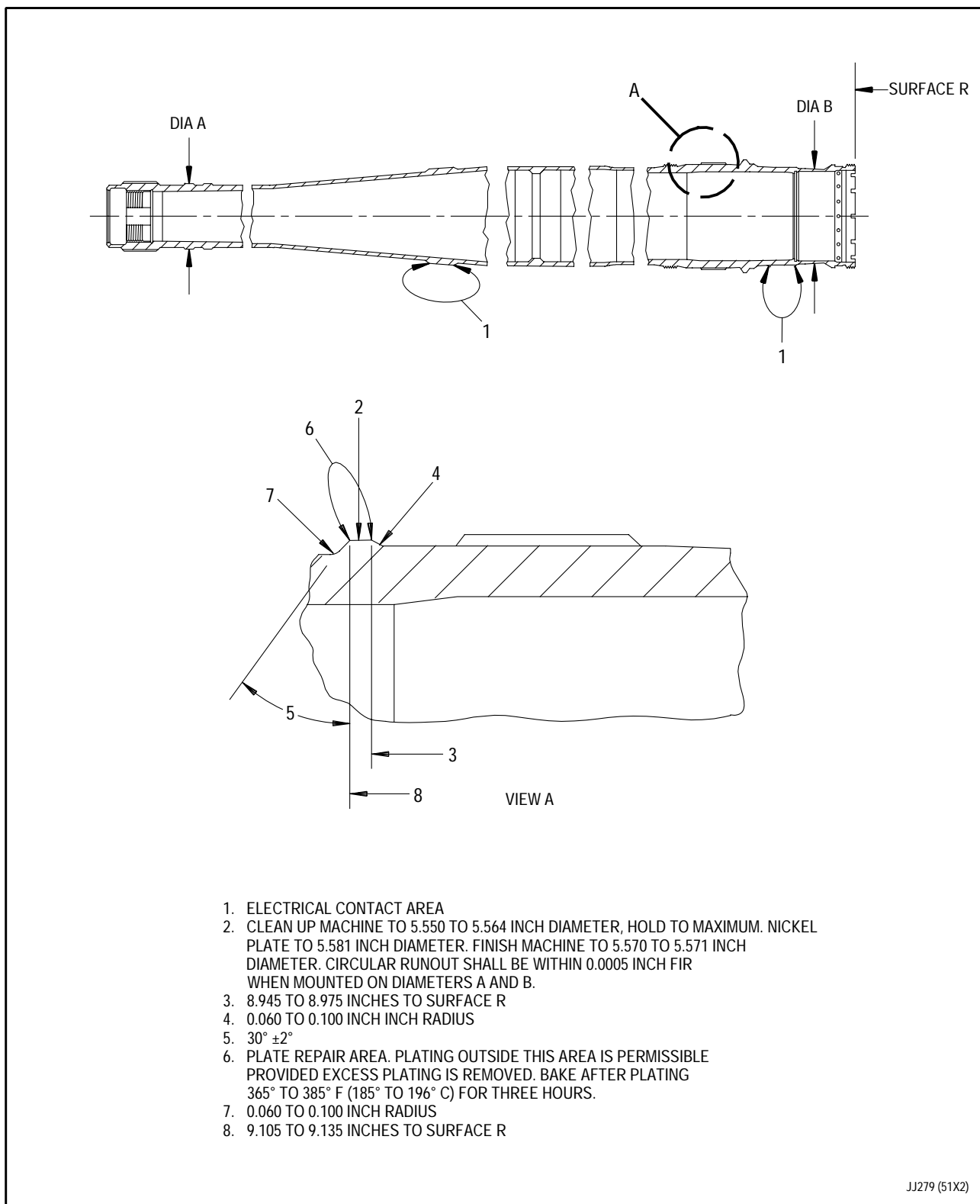


Figure 7. Front Compressor Drive Turbine Shaft - Rear Turbine Hub Forward Snap Diameter Repair

**9. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - REAR TURBINE HUB REARWARD
SNAP DIAMETER REPAIR.**

(See Figure 8.)

- a. Clean up machine worn surfaces to dimensions(2 and 7, figure 8).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. Nickel plate area(4) to dimensions(2 and 7). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated areas to dimensions(2, 3, 5, 7, and 8).
- f. Ensure final dimensions(2 and 3) are not exceeded.

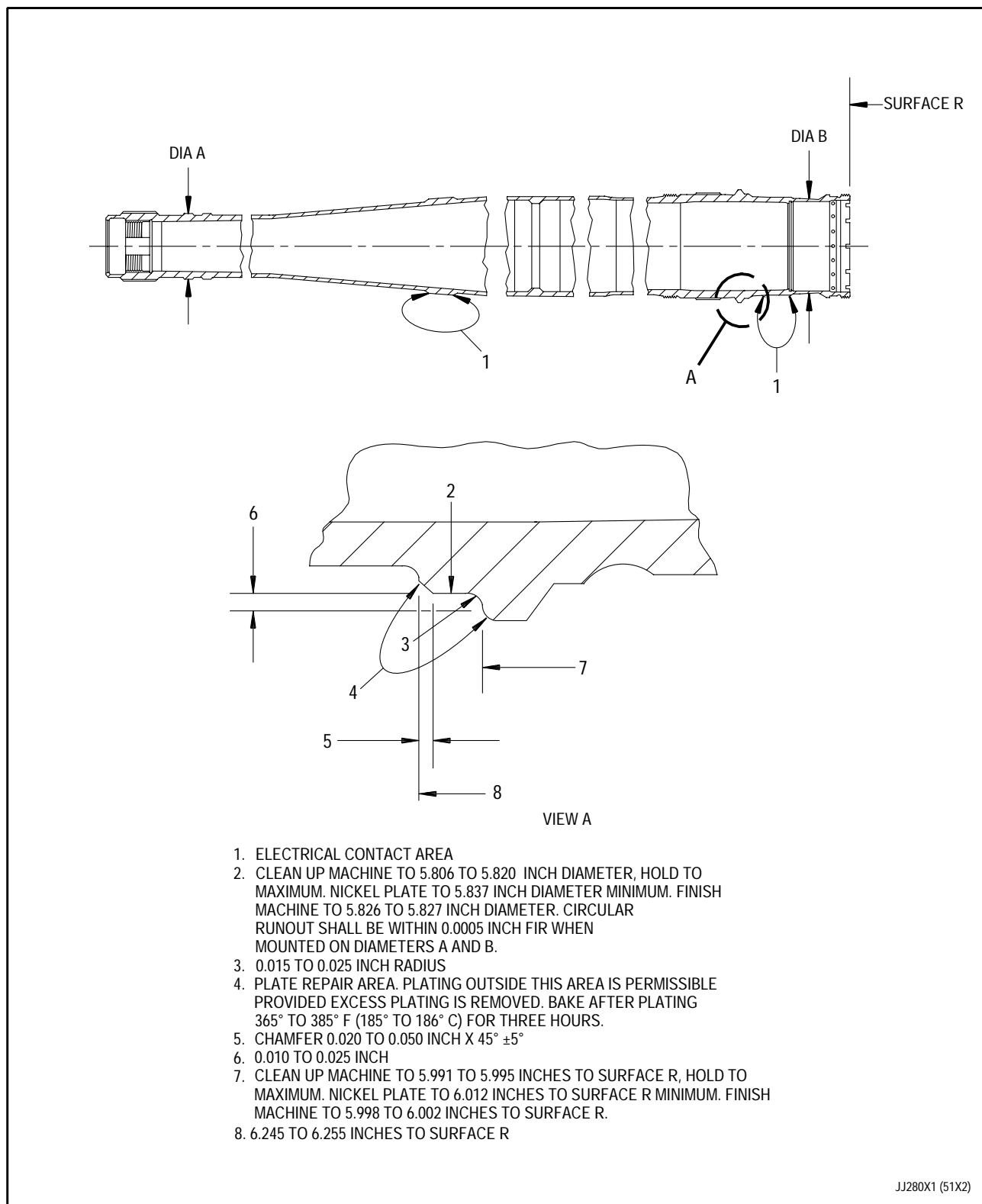


Figure 8. Front Compressor Drive Turbine Shaft - Rear Turbine Hub Rearward Snap Diameter Repair

**10. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - NO. 5 BEARING HEAT SHIELD FRONT
SNAP DIAMETER REPAIR.**

(See Figure 9.)

- a. Clean up machine worn diameter to dimensions(2, 6, and 7, figure 9).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. Nickel plate area(4) to dimensions(2 and 8). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated areas to dimensions(2, 6, and 7).
- f. Ensure final dimension(2) is not exceeded.

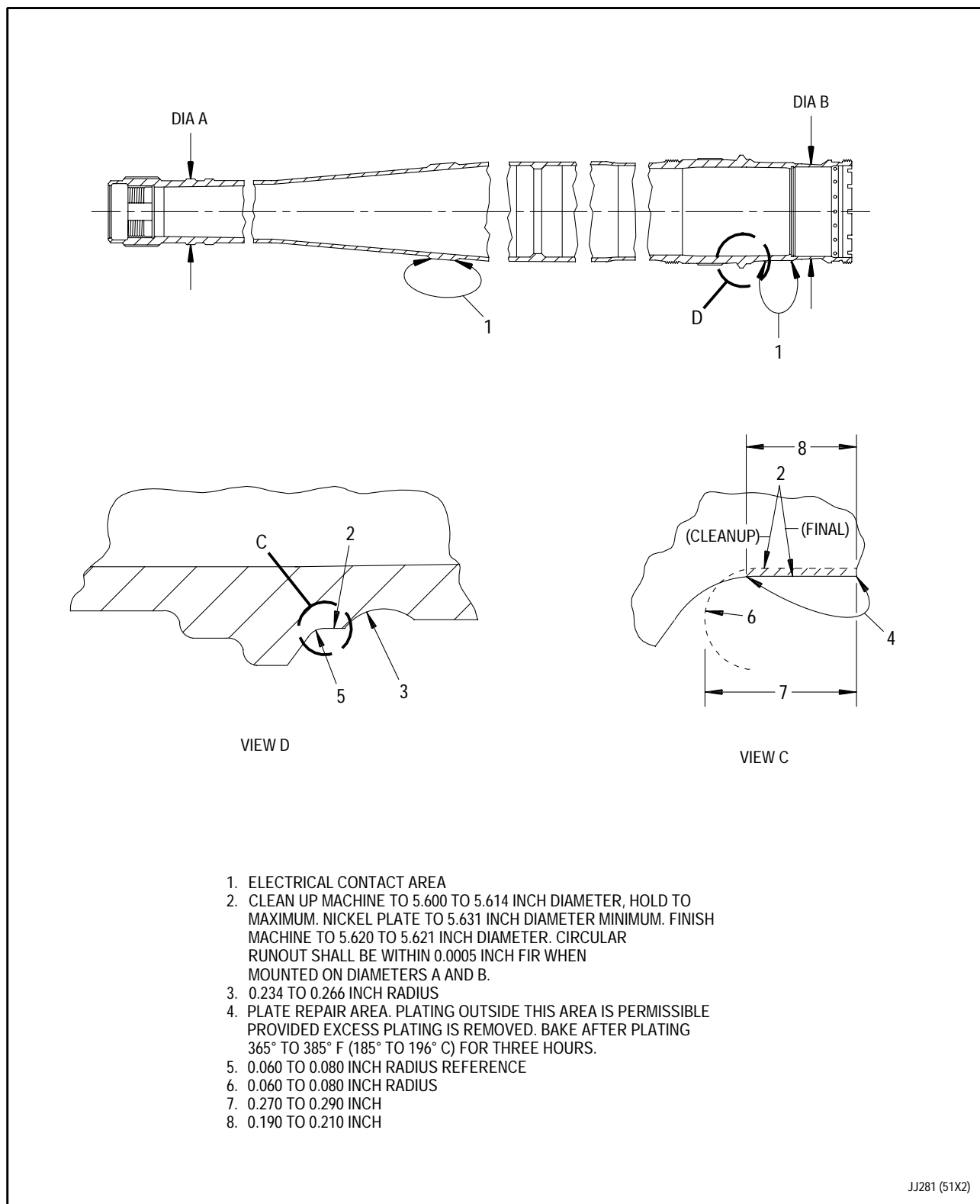
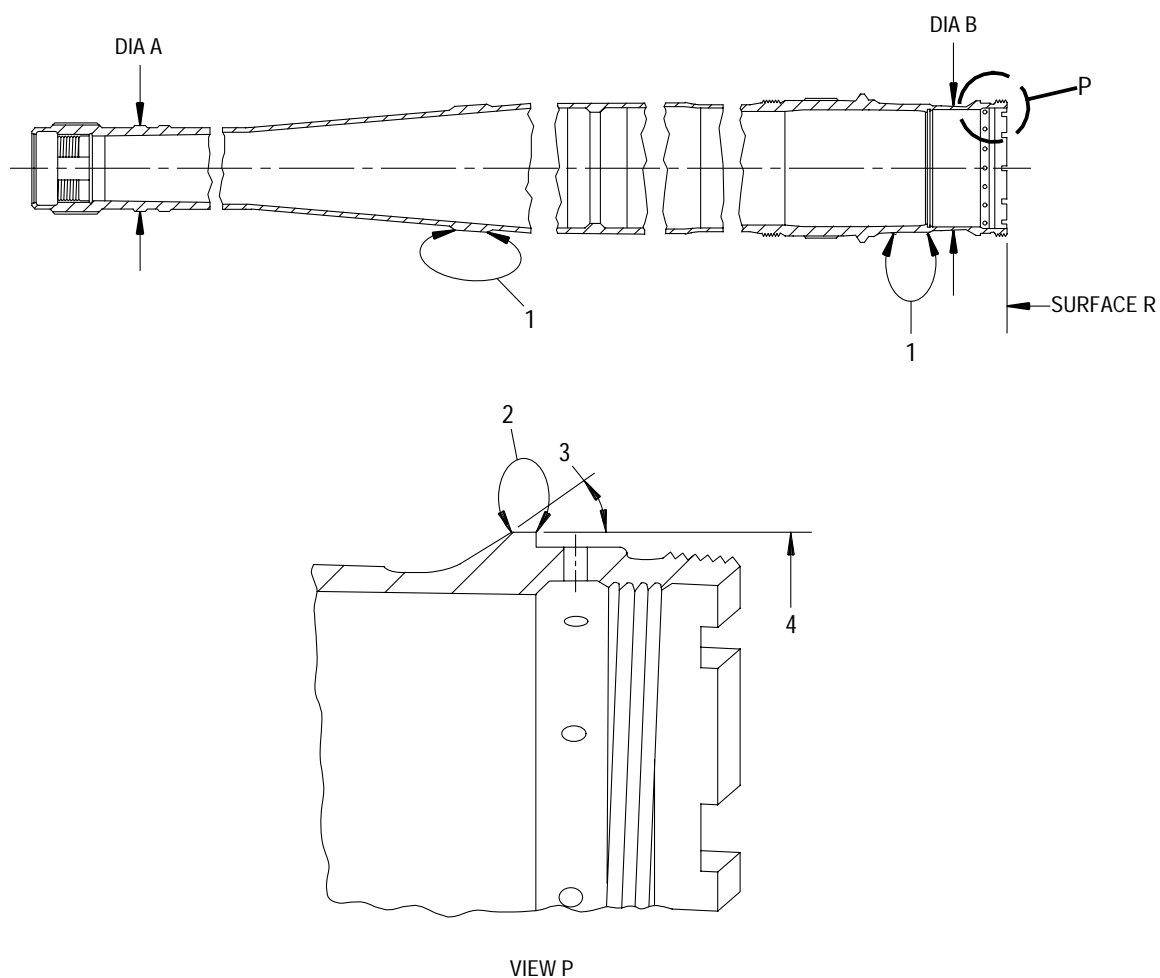


Figure 9. Front Compressor Drive Turbine Shaft - No. 5 Bearing Heat Shield Front Snap Diameter Repair

**11. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - NO. 5 BEARING HEAT SHIELD REAR
SNAP DIAMETER REPAIR.**

(See Figure 10.)

- a. Clean up machine worn diameter to dimension(4, figure 10).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. Nickel plate area(2) to dimension(4). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated area to dimensions(3 and 4).
- f. Ensure final dimension(4) is not exceeded.



1. ELECTRICAL CONTACT AREA
2. PLATE REPAIR AREA. PLATING OUTSIDE THIS AREA IS PERMISSIBLE PROVIDED EXCESS PLATING IS REMOVED. BAKE AFTER PLATING 365° TO 385° F (185° TO 196° C) FOR THREE HOURS.
3. 30° ±5°
4. CLEAN UP MACHINE TO 5.516 TO 5.529 INCH DIAMETER, HOLD TO MAXIMUM. NICKEL PLATE TO 5.546 INCH DIAMETER MINIMUM. FINISH MACHINE TO 5.534 TO 5.536 INCH DIAMETER. CIRCULAR RUNOUT SHALL BE WITHIN 0.0005 INCH FIR WHEN MOUNTED ON DIAMETERS A AND B.

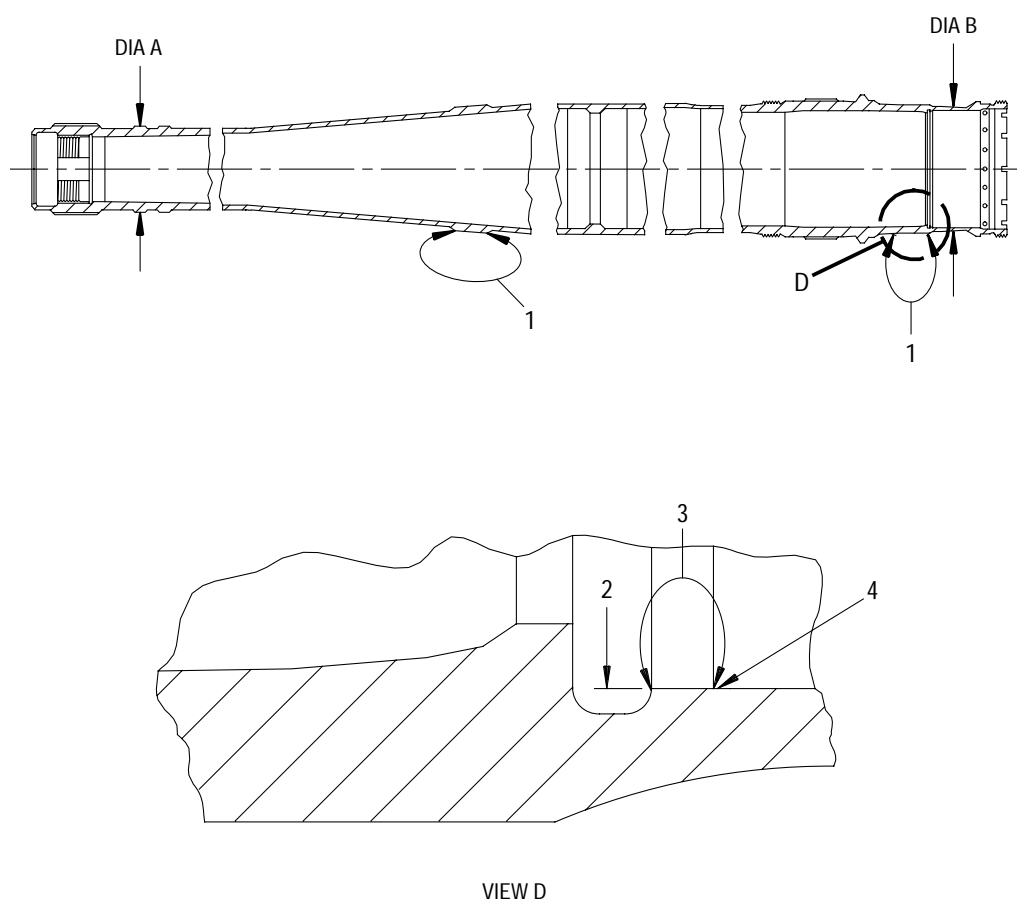
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Figure 10. Front Compressor Drive Turbine Shaft - No. 5 Bearing Heat Shield Rear Snap Diameter Repair

**12. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - NO. 5 BEARING PLUG SNAP DIAMETER
REPAIR.**

(See Figure 11.)

- a. Clean up machine worn diameter to dimension(2, figure 11).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. Nickel plate area(3) to dimension(2). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated area to dimensions(2 and 4).
- f. Ensure final dimension(2) is not exceeded.



1. ELECTRICAL CONTACT AREA
2. CLEAN UP MACHINE TO 4.912 TO 4.925 INCH DIAMETER, HOLD TO MINIMUM. NICKEL PLATE TO 4.895 INCH DIAMETER. FINISH MACHINE TO 4.905 TO 4.907 INCH DIAMETER. CIRCULAR RUNOUT SHALL BE WITHIN 0.001 INCH FIR WHEN MOUNTED ON DIAMETERS A AND B.
3. PLATE REPAIR AREA. PLATING OUTSIDE THIS AREA IS PERMISSIBLE PROVIDED EXCESS PLATING IS REMOVED. BAKE AFTER PLATING 365° TO 385° F (185° TO 196° C) FOR THREE HOURS.
4. 0.047 TO 0.078 INCH RADIUS

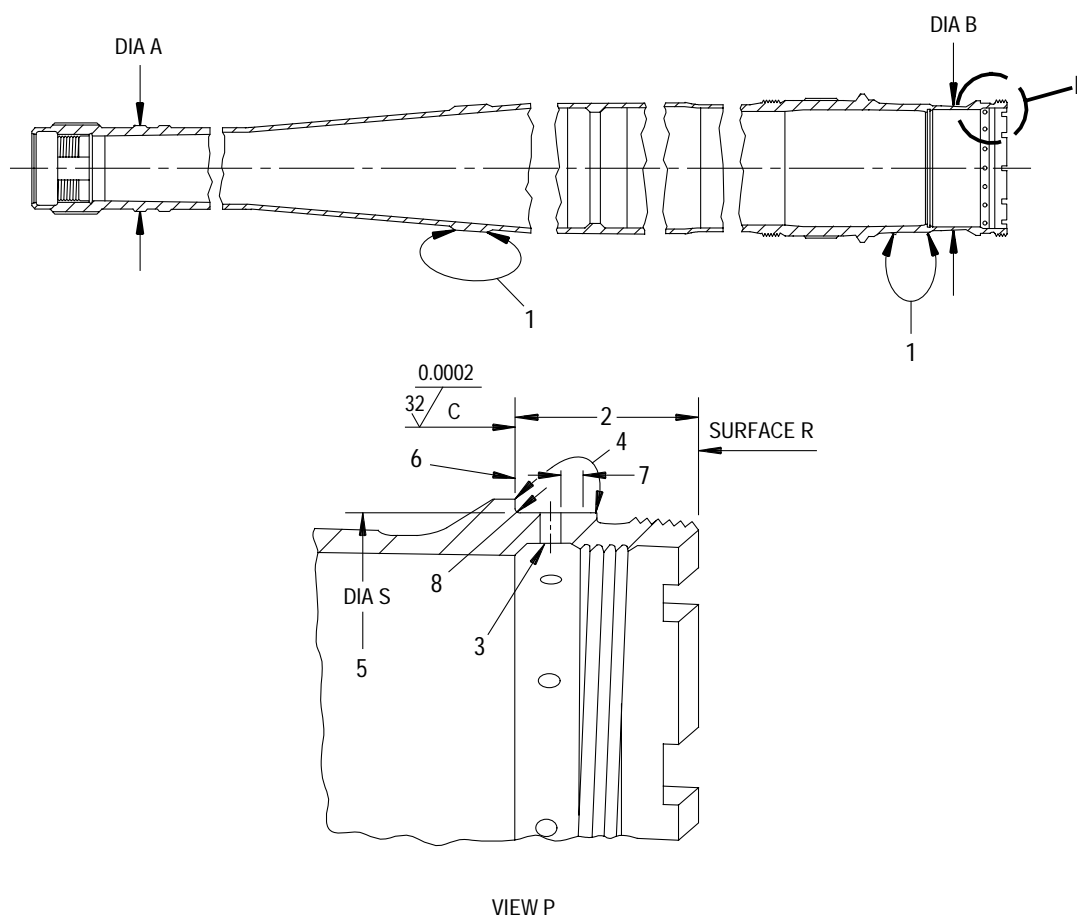
JJ283 (51X2)

Figure 11. Front Compressor Drive Turbine Shaft - No. 5 Bearing Plug Snap Diameter Repair

**13. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - SEAL SEAT SNAP DIAMETER REPAIR.**

(See Figure 12.)

- a. Clean up machine worn surfaces to dimensions(2 and 5, figure 12).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. Nickel plate area(4) to dimensions(2 and 5). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated areas to dimensions(2, 5, 7, and 8). Maintain perpendicularity(6).
- f. Ensure final dimension(6) is not exceeded.



1. ELECTRICAL CONTACT AREA
2. CLEAN UP MACHINE TO 1.004 TO 1.008 INCHES, HOLD TO MINIMUM. NICKEL PLATE TO 0.993 INCHES MAXIMUM DIMENSION. FINISH MACHINE TO 0.998 TO 1.002 INCHES.
3. ENSURE THESE HOLES ARE MASKED. HOLES SHALL BE FREE OF PLATE.
4. PLATE REPAIR AREA. PLATING OUTSIDE THIS AREA IS PERMISSIBLE PROVIDED EXCESS PLATING IS REMOVED. BAKE AFTER PLATING 365° TO 385° F (185° TO 196° C) FOR THREE HOURS.
5. CLEAN UP MACHINE TO 5.361 TO 5.375 INCH DIAMETER, HOLD TO MAXIMUM. NICKEL PLATE TO 5.391 INCH DIAMETER MINIMUM. FINISH MACHINE TO 5.380 TO 5.381 INCH DIAMETER. CIRCULAR RUNOUT SHALL BE WITHIN 0.0005 INCH FIR WHEN MOUNTED ON DIAMETERS A AND B.
6. THIS SURFACE SHALL BE PERPENDICULAR TO DIAMETER S WITHIN 0.0005 INCH TOTAL.
7. 0.062 TO 0.093 INCH DISTANCE AROUND HOLES SHALL BE FREE OF PLATE.
8. 0.005 TO 0.020 INCH RADIUS

JJ284 (51X2)

Figure 12. Front Compressor Drive Turbine Shaft - Seal Seat Snap Diameter Repair

**14. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - NO. 5 BEARING JOURNAL REPAIR.**

(See Figure 13.)

- a. Clean up machine worn diameter to dimensions(4, 8, and 9, figure 13). Maintain dimension(7) all around.
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. If shotpeen option is chosen, peen with intensity equivalent to 6A. Refer to AMS 2430.
- d. Chromium plate area(3) to dimensions(4 and 5). Refer to T.O. 2J-F100-53-1, SWP 092 06 (SPOP 22).
- e. Remove fixture from shaft.
- f. If shotpeen option was not used, bake after plate at 725° to 775°F (385° to 413°C) for two hours. If shotpeen option was used (step c.), bake at 350° to 400°F (177° to 204°C) for three hours.
- g. Finish machine plated areas to dimensions(2, 4, 8 and 9). Maintain concentricity.
- h. Ensure final dimension(4) is not exceeded.

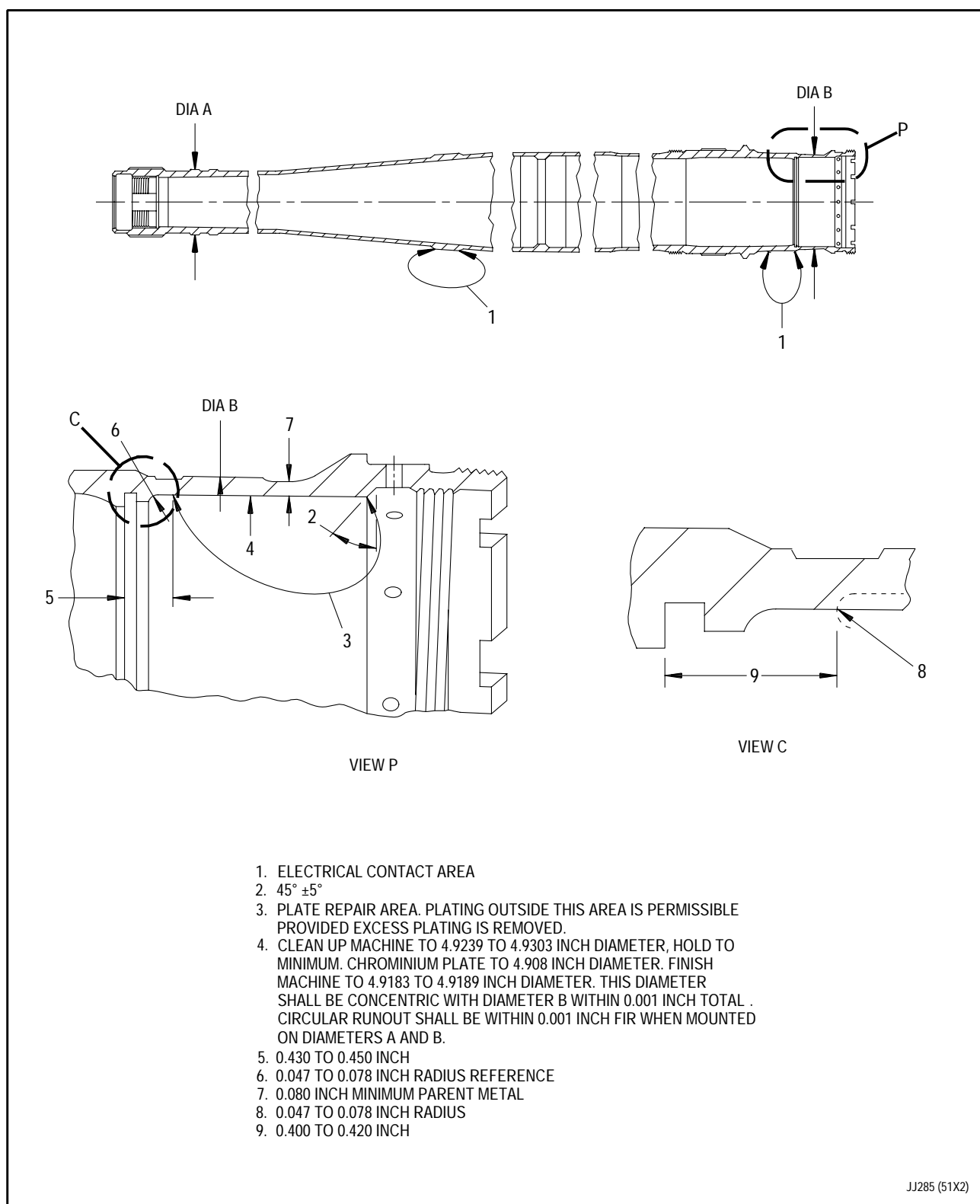
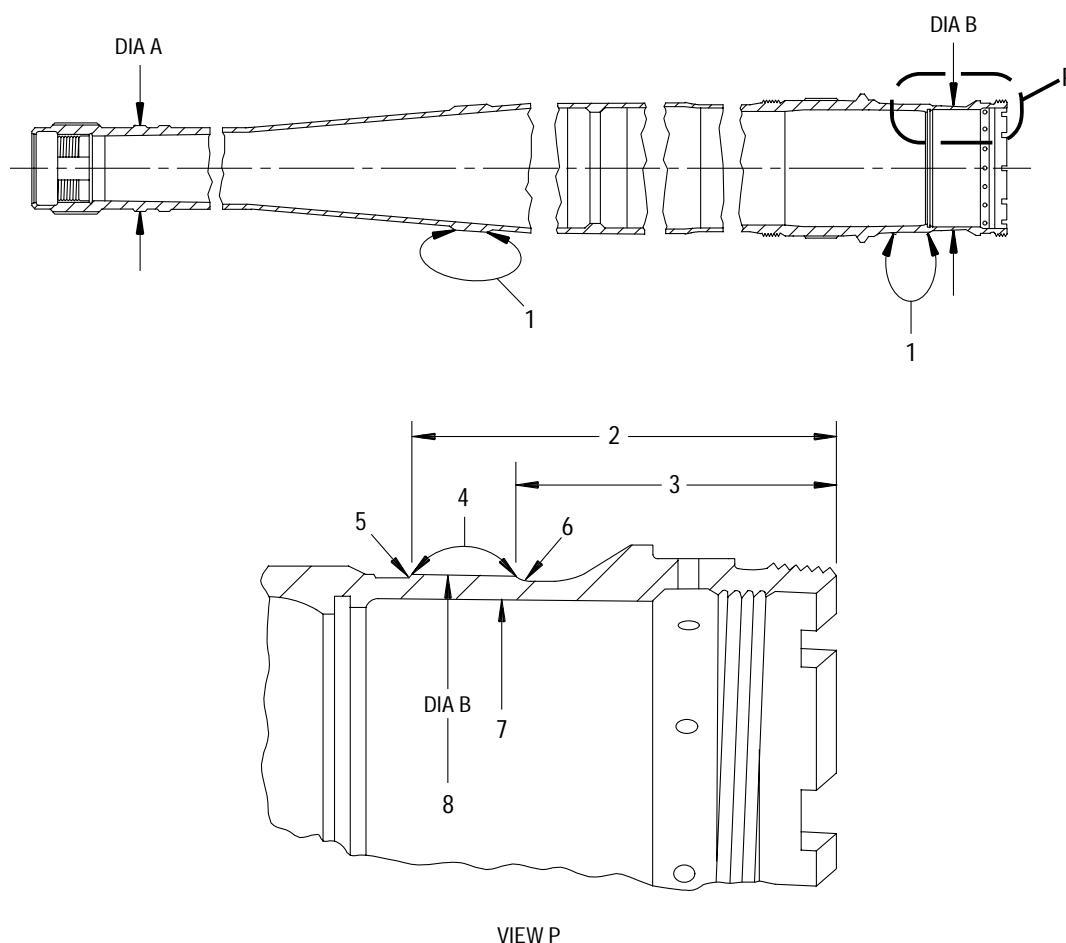


Figure 13. Front Compressor Drive Turbine Shaft - No. 5 Bearing Journal Repair

**15. FRONT COMPRESSOR TURBINE SHAFT -
BALANCE BEARING JOURNAL REPAIR.**

(See Figure 14.)

- a. Clean up machine worn diameter to dimension(8, figure 14).
- b. Install PWA 52941 plating fixture. Refer to paragraph 3.
- c. Nickel plate area(4) to dimension(8). Refer to T.O. 2J-F100-53-1, SWP 092 11 (SPOP 29).
- d. Remove fixture from shaft.
- e. Finish machine plated area to dimensions(2, 3, and 8). Maintain concentricity.
- f. Ensure final dimension(8) is not exceeded.



1. ELECTRICAL CONTACT AREA
2. 2.600 INCH MINIMUM
3. 1.740 TO 1.800 INCH TO SURFACE R
4. PLATE REPAIR AREA. PLATING OUTSIDE ENCLOSED AREA IS PERMISSIBLE PROVIDED EXCESS PLATING IS REMOVED. BAKE AFTER PLATING 365° TO 385° F (185° TO 196° C) FOR THREE HOURS.
5. 0.109 INCH RADIUS MINIMUM
6. 0.109 TO 0.141 INCH RADIUS
7. 4.9183 TO 4.9189 INCH DIAMETER REFERENCE
8. CLEAN UP MACHINE TO 5.126 TO 5.139 INCH DIAMETER, HOLD TO MAXIMUM. NICKEL PLATE TO 5.156 INCH DIAMETER. FINISH MACHINE TO 5.144 TO 5.146 INCH DIAMETER. THIS DIAMETER B SHALL BE CONCENTRIC TO DIAMETER 7 WITHIN 0.001 INCH TOTAL. CIRCULAR RUNOUT SHALL BE WITHIN 0.0005 INCH FIR WHEN MOUNTED ON DIAMETERS A AND B.

JJ286 (51X2)

Figure 14. Front Compressor Drive Turbine Shaft - Balance Bearing Journal Repair

**16. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - PROCEDURE FOR PROCESSING
SHAFTS PITTED IN AREAS OTHER THAN SNAP
DIAMETERS OR MATING SURFACES.**

- a. Mask areas not to be blasted.



Ensure even travel of nozzle as
it passes down length of shaft.

- b. Wet glass bead blast shaft OD
until surfaces are clean. Refer
to T.O. 2J-F100-53-1, SWP 031 03
(SPOP 16).
- c. Wet abrasive blast shaft ID.
Refer to T.O. 2J-F100-53-1,
SWP 031 19 (SPOP 9).

**17. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - SLOT DAMAGE REPAIR.**

(See Figure 15.)

NOTE

This repair is for shaft slot
sides damaged through use of
PWA 51960 holder and PWA 53361
adapters.

- a. Select slot with most damaged
side and machine to remove.
Remove minimum amount of
material maintaining radius(5,
figure 15). Do not exceed
dimensions(1 and 2).
- b. Machine same side of all
remaining slots maintaining
dimensions(1, 2, and 5). Index
shaft to each successive slot
location.
- c. Repeat steps (a) and (b) for
opposite side of slots to remove
damage. Do not exceed
dimensions(1 and 3). Maintain
radius(5).
- d. Dimensionally check finished
slot(s) to meet true position(3)
requirement.

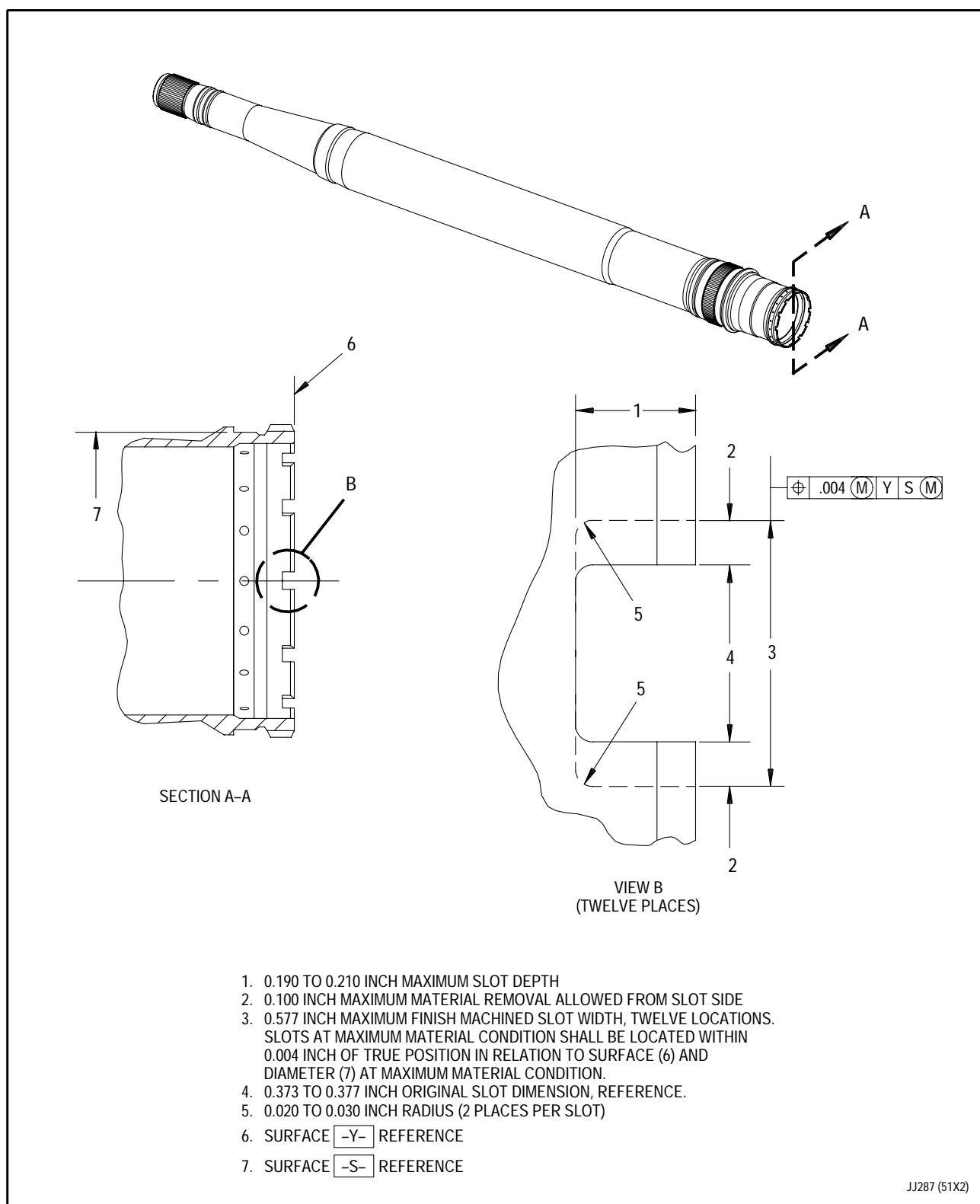


Figure 15. Front Compressor Drive Turbine Shaft - Slot Damage Repair

**18. FRONT COMPRESSOR DRIVE TURBINE
SHAFT - HEAT AND CORROSION RESISTANT
PAINT APPLICATION.**

(See Figure 16.)

NOTE

- Ensure all plating repairs have been completed prior to this procedure.
 - Isolated defects or marred spots on SermeTel W, or Alseal 518 coated areas may be given a touch-up. Refer to T.O. 2J-F100-53-1, SWP 097 03 (SPOP 147 and 162), except SermeTel 249 shall not be used.
 - May be cured at 450°F (232°C) for 2 1/2 hours instead of 625° to 675°F (329° to 357°C) for 30 minutes. Omit 975° to 1025°F (524° to 552°C) post cure. No rebalance is required after touch-up.
- a. Apply one coat of PWA 595 (SermeTel W), or PWA 492 (Alseal 518) paint 0.002 inch maximum thickness to shaft except areas indicated no paint (NP). (See figure 16.) First coating thickness shall be at least 0.0008 inch. Refer to T.O. 2J-F100-53-1, SWP 097 03 (SPOP 147 and 162).

- b. Burnish to induce galvanic corrosion protection.
- c. Remove masking.
- d. Refer to paragraph 19 for antigalling compound application.

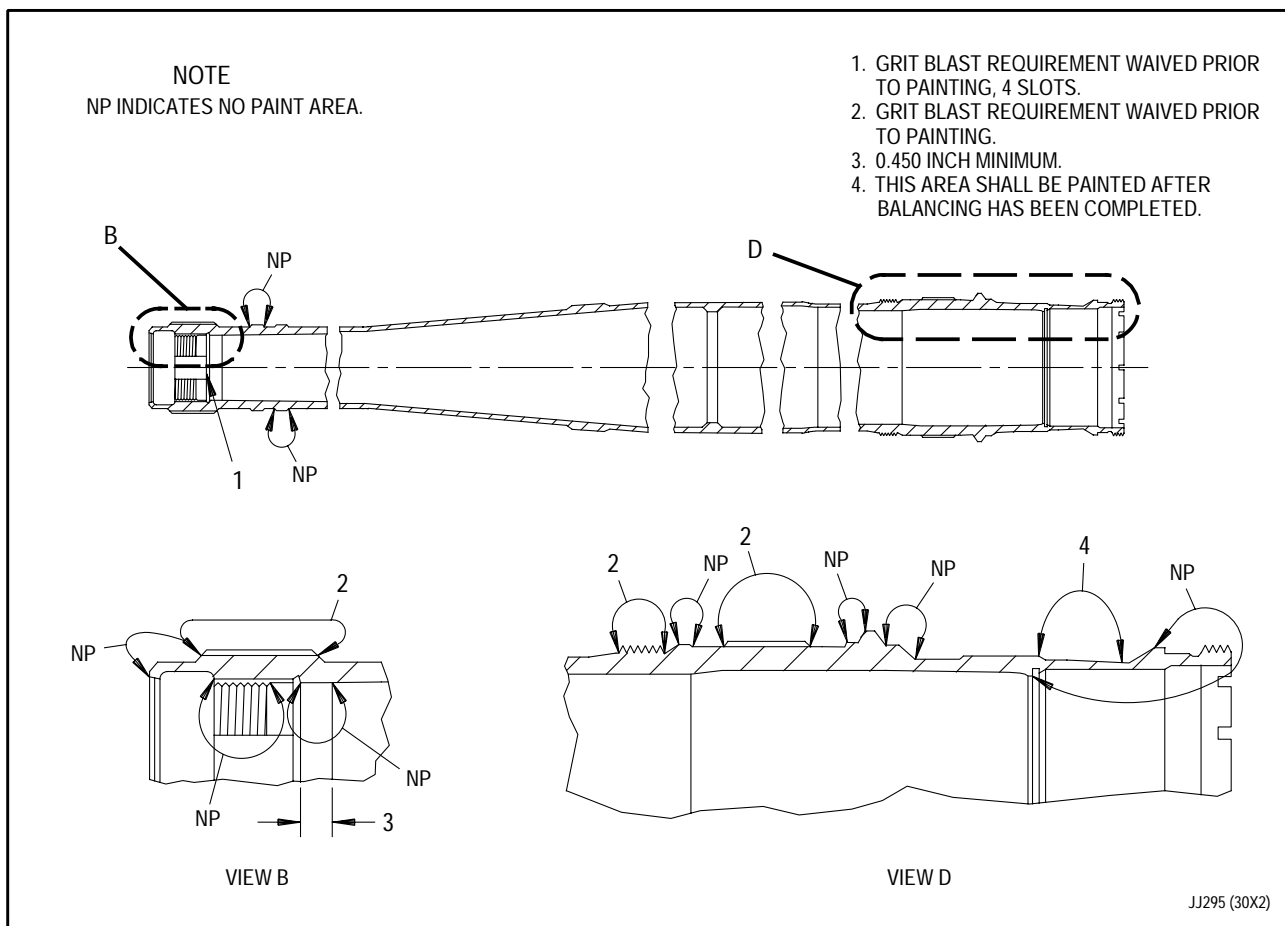


Figure 16. Front Compressor Drive Turbine Shaft - Heat and Corrosion Resistant Paint Application

19. FRONT COMPRESSOR DRIVE TURBINE SHAFT ASSEMBLY - ANTIGALLING COMPOUND APPLICATION.

(See Figure 17.)

NOTE

Ensure all plating and paint repairs have been completed and shaft has been balanced per T.O. 2J-F100-53-9, WP 601 00, prior to performing this procedure.

- a. Inspect threads and slots(3, figure 17) for complete removal of all foreign matter.

NOTE

Surface preparation is not required, except on threads and slots(3).

- b. Apply PWA 36545 antigalling compound to areas shown. Refer to T.O. 2J-F100-53-1, SWP 098 07 (SPOP 748). Remove excess antigalling compound by brushing with a brass brush. Do not expose underlying metal.

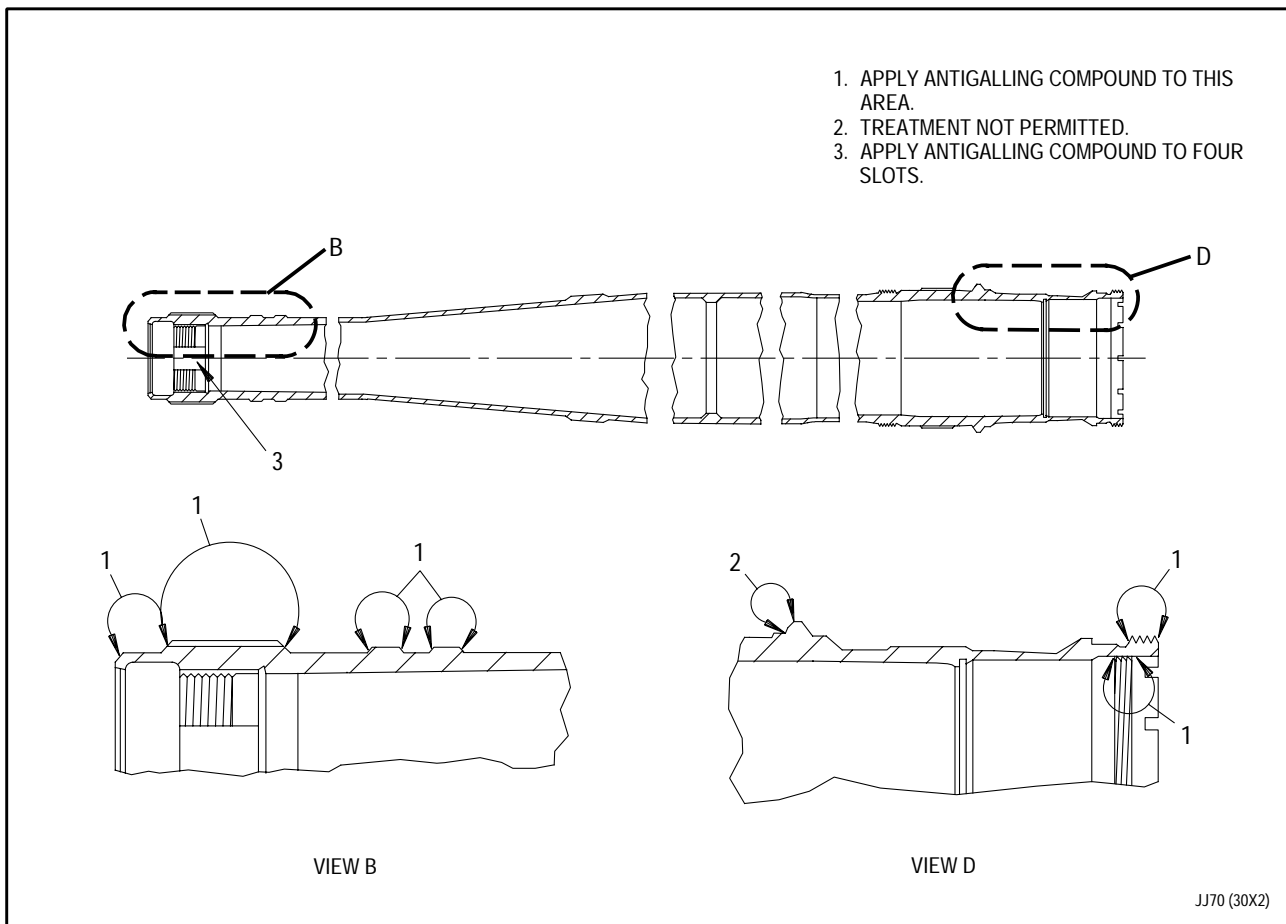


Figure 17. Front Compressor Drive Turbine Shaft Assembly - Antigalling Compound Application

WORK PACKAGE

TECHNICAL PROCEDURES

RING SEGMENT, ASSEMBLY, AIR SEALING, TURBINE, THIRD STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 5	0	6 Blank	0		

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Rivet	AN123619	As Required

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 3rd-stage turbine air sealing ring segment assembly.

**2. THIRD STAGE TURBINE AIR SEALING RING
SEGMENT ASSEMBLY - SEAL REPLACEMENT.**

(See Figure 1.)

- a. Using carbide or cobalt bit, drill or grind off upset end of rivets from the seal side of segment.
- b. Remove and discard unserviceable seal PN 4069975. Retain seal for reuse if undamaged.
- c. Position new seal PN 4069975 on ring segment to dimensions shown and clamp in place.

- d. Transfer drill four holes in seal 0.096 to 0.100 inch. Remove seal and break edge 0.003 to 0.015 at four holes, on both sides of seal.

NOTE

Serviceable seals which are to be reused must be reinstalled on the same segment assembly from which they were removed.

- e. Reinstall serviceable seal or install new seal using 4 rivets (PN AN123619). Refer to T.O. 2-1-111.

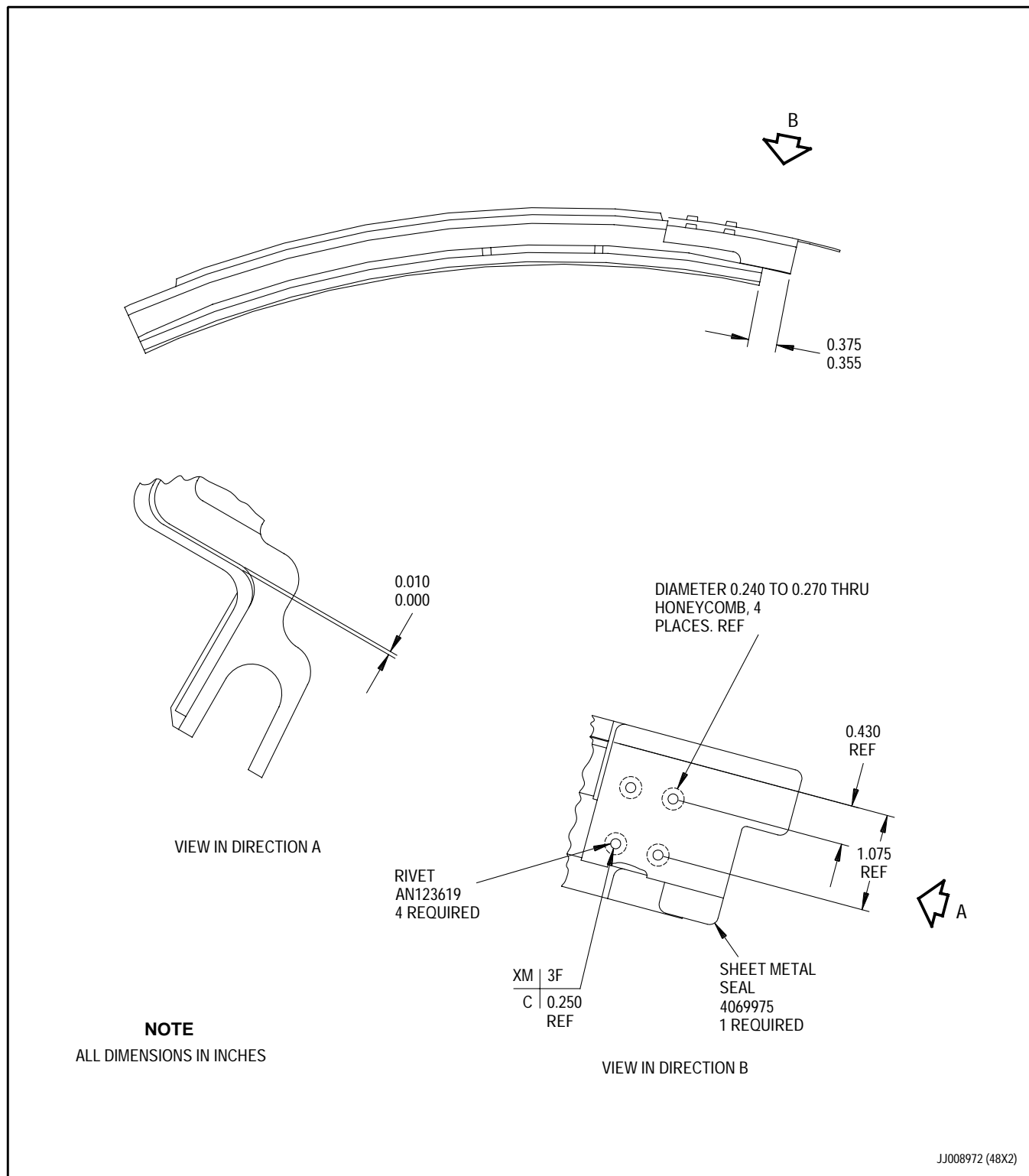


Figure 1. Third Stage Turbine Air Sealing Ring Segment Assembly - Seal Replacement

WORK PACKAGE**TECHNICAL PROCEDURES****CASE ASSEMBLY - TURBINE, REAR -
AND
SUPPORT AND DUCT SET - TURBINE, REAR****REPAIR****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 14

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	24	8	24	9	24
2	21	8A Added	24	10	16
3 - 7	16	8B Blank Added	24	11 - 12	21

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-51-1
Qualified Repair Source List (QSRL) -	
Rear Compressor Drive Turbine - - - - -	WP 604 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

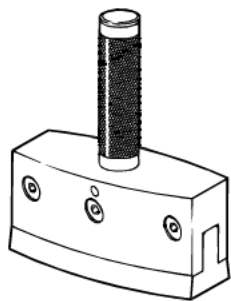
EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Rivet	AN123319	As required
Rivet	ST2213-02	As required

APPLICABLE SUPPORT EQUIPMENT

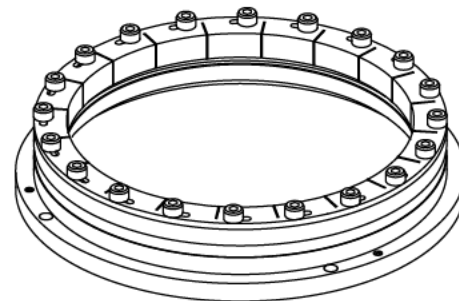
Paragraph	Function - Tool Nomenclature	Tool Number
6	Rear Turbine Support and Duct Set - Duct Segment Replacement (All New Segments)	
	Driver - - - - -	PWA 53354
	Machining Fixture - - - - -	PWA 57776
	Set Master - - - - -	PWA 57778
7	Rear Turbine Support and Duct Set - Duct Segment Replacement (Partial - Less Than All New Segments)	
	Driver - - - - -	PWA 53354
	Machining Fixture - - - - -	PWA 57776

ILLUSTRATED SUPPORT EQUIPMENT



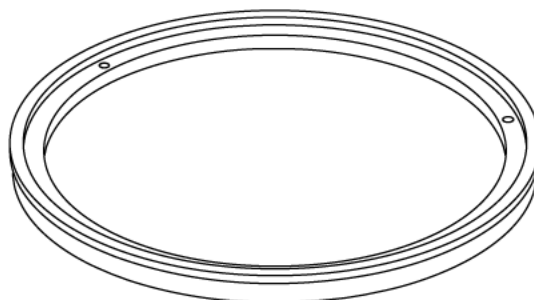
PWA 53354 -C

Figure T1. PWA 53354 Driver



PWA 57776 -C

Figure T2. PWA 57776 Machining Fixture



PWA 57778 -C

Figure T3. PWA 57778 Set Master

1. INTRODUCTION.

- a. This work package contains instructions for repair of rear turbine case assembly, rear turbine support and duct set, and rear turbine case and duct set.

2. REAR TURBINE CASE ASSEMBLY - BLEND REPAIR.

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable nicks and scratches in rear turbine case as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal.
 - (3) Blend repair nicks and scratches up to 0.005 inch deep.
- c. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9. No cracks allowed.

3. REAR TURBINE CASE ASSEMBLY - PIN REPLACEMENT.

(See Figure 1.)

- a. Replace headless shoulder pin(6, figure 1) as follows:
 - (1) Remove unserviceable pin by drifting from forward side of rear OD flange, using standard drift.
 - (2) Install new pin(6) using standard drift (see figure 1, Section C-C).
- b. Replace headless shoulder pin(5) as follows:
 - (1) Remove unserviceable pin from forward OD flange by grinding and drilling off flared end from rear of flange. Do not remove parent material from flange.
 - (2) Install new pin(5) from forward side of flange and flare securely on rear side of flange (see figure 1, Section G-G).

Legend for figure 1

- 1. Bracket - identification plate (PN 4052460)
- 2. Rivet - blind, universal (ST2213-02) 4 required
- 3. Plate - identification (PN 4075518)
- 4. Rivet - solid universal head (AN123319) 4 required
- 5. Pin - headless shoulder (PN 4073616)
- 6. Pin - headless shoulder (PN 585406)

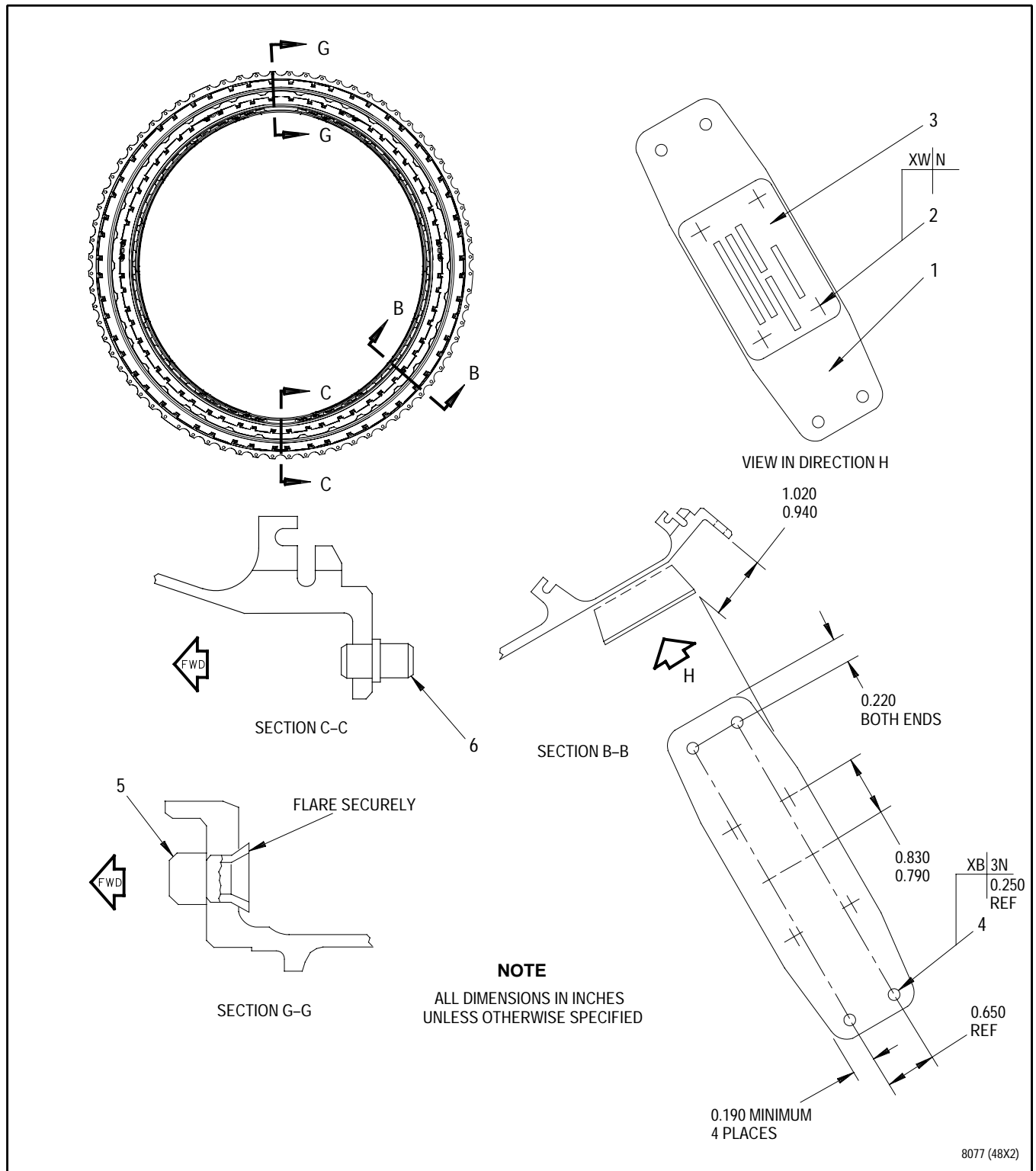


Figure 1. Rear Turbine Case Assembly - Pin Replacement and Identification Plate/Bracket Replacement

**4. REAR TURBINE CASE ASSEMBLY -
IDENTIFICATION PLATE/BACKET
REPLACEMENT.**

(See figure 1.)

NOTE

Identification plate is not a detail of case assembly but it shall be transferred from old bracket to new bracket, if bracket is being replaced, or from unreparable case assembly to new case assembly.

a. Identification plate replacement:

- (1) Remove blind rivets(2) by grinding rivet heads.
- (2) Secure serviceable or new identification plate(3) to bracket(1) with blind rivets(2). Refer to T.O. 2-1-111.
- (3) If using new identification plate, transfer all applicable data to new plate.

b. Identification plate bracket replacement:

- (1) Remove blind rivets(2) by grinding rivet heads and remove ID plate(3).
- (2) Remove solid rivets(4) by grinding rivets heads. Remove rivets and bracket(1).
- (3) Position new bracket(1) onto case as shown.
- (4) Use a No. 40 carbide or cobalt drill to transfer drill four rivet holes into bracket(1).
- (5) Secure new bracket to case with rivets(4). Refer to T.O. 2-1-111.
- (6) Position ID plate(3) onto bracket and secure with blind rivets(2).

5. SECOND STAGE TURBINE DUCT SUPPORT - METAL SPLATTER REPAIR.

- a. Chip metal splatter off with a sharp tool using care not to damage base material.
- b. Chip off to within 0.000 to 0.010 inch of parent material.

6. REAR TURBINE SUPPORT AND DUCT SET - DUCT SEGMENT REPLACEMENT (ALL NEW SEGMENTS).

(See Figure 2.)

- a. Remove 2nd stage turbine duct segments using PWA 53354 driver to drift them rearward from 2nd stage turbine duct support. Tap drift evenly all round to avoid cracking segments.



Failure to install correct F100-PW-229 parts will result in engine hardware damage. F100-PW-229 and F100-PW-220 second stage turbine support and duct set are physically interchangeable but are designed for different cooling air levels.

- b. Install 20 new duct segments into turbine duct support as follows:
 - (1) Identify segments with serial number of matching support and location number 1 through 20 using vibrapeen. (See figure 2).

- (2) Install two shims 1/2 inch wide by 0.004 inch thick on duct segment support to hold duct segments inward. Shims should cover duct segment support ring for 360 degrees with no overlap.
- (3) Place center of first segment at location marked "O" on support. Place remaining segments in clockwise sequence, viewed from rear. Start segments into turbine duct support aligning rear hooks of segments with slots in support ring.
- (4) Position support on bench forward flange down.
- (5) Seat duct segments using PWA 53354 driver and hammer.
- (6) Inspect for proper seating of duct segment sets. (See figure 2.)
- (7) Check duct segments for looseness. No radial looseness allowed. If segment is loose, remove loose segment and shim with 0.001 to 0.005 inch shim stock until segment is tight. Repeat steps (5) through (7).

c. Install PWA 57776 machining fixture onto machine tool as follows:

- (1) Wipe PWA 57776 machining fixture clean and visually inspect for any missing details that may affect fixture operation.
- (2) Prepare PWA 57776 detail-1 chuck assembly as follows:
 - (a) Remove refill screw.
 - (b) Turn actuating screw until oil comes out of refill hole.
 - (c) Back out actuating screws and adjust screw, where provided, until flush with body or top of threads.
 - (d) Install grease fitting provided.



Failure to use specified hydraulic oil may result in hydraulic chuck failure.

- (e) Fill a hand operated grease gun using hydraulic oil with a viscosity of 300 SUS at 100° F.
- (f) Attach hand operated grease(oil) gun to fitting and fill until pistons move back against screw. Usually, only a small amount is needed.
- (g) Remove grease(oil) gun and grease fitting.
- (h) Replace refill screw tightly.

- (3) Install three 5/8 inch diameter x eight inch long lift eyes to lift fixture.
- (4) Load fixture on machine tool face plate or table.
- (5) Remove aluminum clamp ring by loosening 20 1/2-13 screws securing ring and rotating ring.
- (6) Ensure adjusting screws in ID of fixture base are fully retracted into fixture.
- (7) Use dial indicator on machined OD groove for rough location (centering) of fixture prior to installing master. Locate within 0.002 inch FIR.
- (8) Back out hydraulic chuck actuating screws, counterclockwise, until flush with body or top of threads.
- (9) Wipe PWA 57778 set master clean. Load set master onto fixture with set master lettering facing up. Ensure "O" mark on set master aligns with "O" mark on fixture.
- (10) Install aluminum clamp ring and handtighten several 1/2-13 screws to hold set master.

- (11) To center and secure set master in fixture, expand chuck by adjusting actuating screws as follows:

NOTE

Adjusting piston serves as a reservoir to prevent tool from running out of fluid.

- (a) Turn adjusting screws clockwise until firm. This refills actuating piston. Never expand tools unless engine part or set master is in place. Do not over expand tool.
- (b) Back adjusting screws out counterclockwise until screws are free of pressure.
- (c) Turn adjusting screws clockwise until light pressure is felt.

NOTE

Offset of 0.002 inch is incorporated in set master and would appear if OD of fixture was once again trammed after indicating set master.

- (12) Indicate set master ring ID to within 0.0005 inch FIR and 0.001 inch flat. Install bolts and secure fixture to the machine table.
- (13) Turn chuck actuating screws counterclockwise until flush with body or top of thread. Remove aluminum clamp ring and set master.

- d. Install support and duct set into PWA 57776 fixture as follows:



Do not force parts on tool, damage to engine parts and/or tool may result.

- (1) Ensure parts are to specified dimensions and tolerances. Install second stage turbine duct support and segments in fixture front side up. Position segment feet over the adjustment screws. Do not raise adjustment screws at this time.
- (2) Align "O" mark on support with "O" mark on top of fixture.
- (3) Install aluminum clamp ring on top of segments and rotate ring into position. Handtighten screws.
- (4) Secure duct support and segments in fixture, expand chuck by adjusting actuating screws as follows:
 - (a) Turn adjusting screws clockwise until firm. This refills actuating piston. Never expand tools unless engine part or set master is in place. Do not over expand tool.
 - (b) Back adjusting screws out counterclockwise until screws are free of pressure.
 - (c) Turn adjusting screws clockwise until light pressure is felt.
- (5) Tighten all 20 1/2-13 clamp ring screws.
- (6) Raise adjustment screws until snug on bottom of segments.

e. Machine duct segments per figure 2 and the following:

- (1) Use vertical grinder with 14 inch diameter, aluminum oxide 60 grit, K hardness grinding wheels. Vendor part numbers are PN 9A60-KSV22 or 7A60-J9V52KS (Brown and Sharp), and PN 38A60-KSUBE or 32A60-J8VBE (Norton Company).
- (2) Use 1700 to 1750 rpm grinding wheel speed with 10 to 20 rpm table speed.
- (3) Maintain 0.001 inch per pass material removal rate with any water soluble coolant.

f. Remove turbine support and duct set from PWA 57776 machining fixture.

g. Use PWA 53354 driver to remove duct segments by drifting them rearward from turbine duct support. Tap drift evenly all around to avoid cracking segments.

h. Remove burrs from edges of segments.

i. Clean rear turbine duct support and duct segments. Refer to T.O. 2J-F100-53-1, SWP 031 01 (SPOP 3).

j. Fluorescent penetrant inspect all machined surfaces of duct segments. Refer to T.O. 2J-F100-9, Type I, Method C. No cracks allowed.

k. Reinstall duct segments without shim in turbine duct support per step b.



Duct segments may be loose. Exercise care when handling support and duct set to prevent duct segments from falling out.

l. Steam clean rear turbine support and duct set.

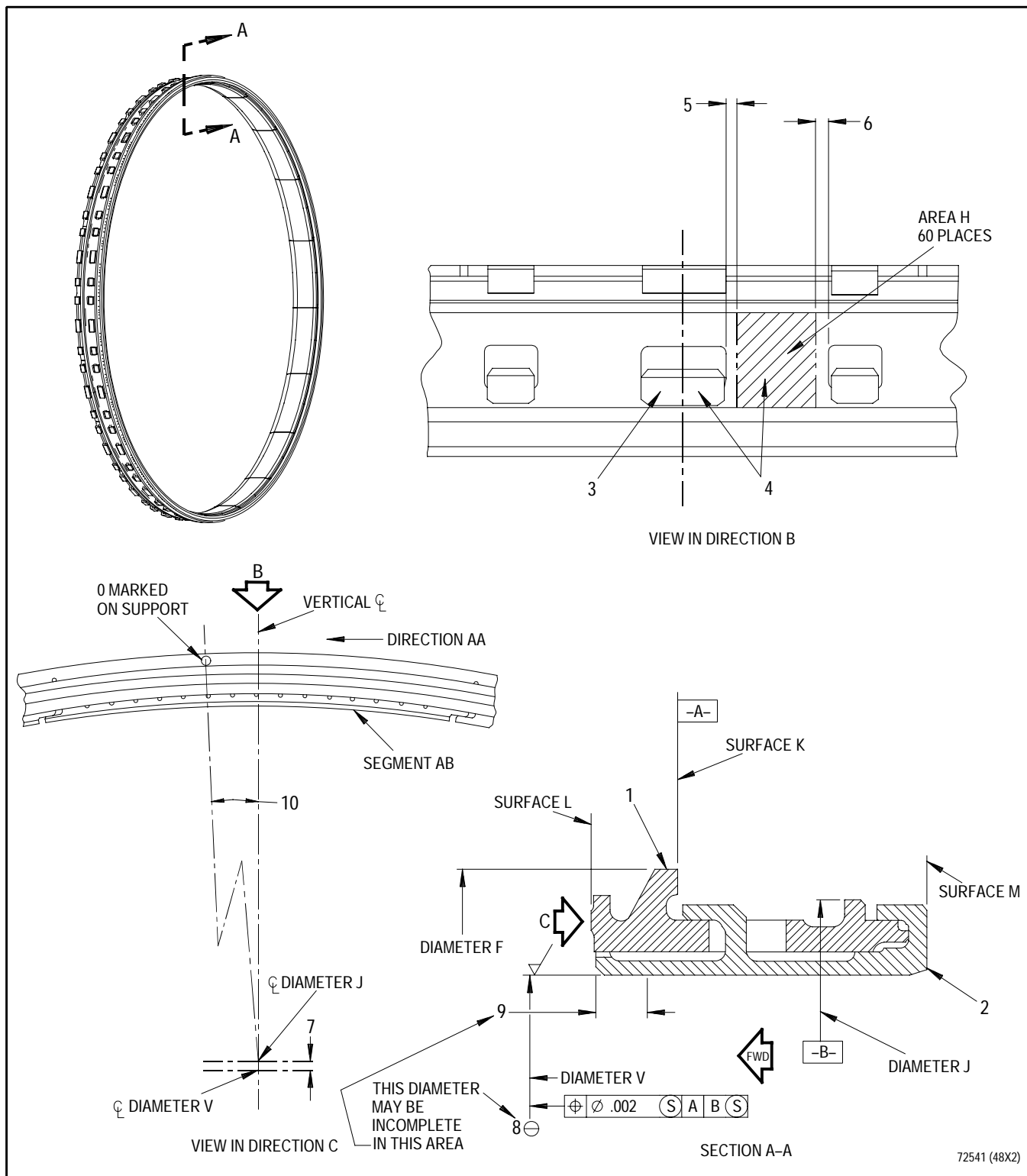


Figure 2. Rear Turbine Support and Duct Set - Duct Segment Replacement (All New Segments)

Legend for figure 2

1. Second stage turbine duct support
2. Second stage turbine duct segment
3. Mark each segment consecutively 1 thru 20 in direction AA beginning with Segment AB.
4. Mark mating number for machined set on support in Area H.
5. 0.100 inch minimum, 40 places
6. 0.100 inch minimum, 40 places
7. 0.002 inch

NOTE

Surface texture shall be 125 unless otherwise specified.

8. 24.832 to 24.836 inches diameter. This diameter applies when segments are loaded radially inward. Surface K is flat within 0.001 inch total and Diameters F and J maintain a clearance envelope of 25.818 inches and 25.531 inches respectively in free state or constrained. Constraint contact allowed only on Surfaces K, L, M, and Diameters F and J. This diameter shall be located within 0.002 inch diameter of true position in relation to Surface K and Diameter J regardless of feature size of this diameter and Diameter J.
9. 0.242 inch maximum
10. 2° 7' Reference

**7. REAR TURBINE SUPPORT AND DUCT SET -
DUCT SEGMENT REPLACEMENT (PARTIAL -
LESS THAN ALL NEW SEGMENTS).**

(See figure 2.)

- a. Remove segments by drifting rearward from front of turbine case, using PWA 53354 driver. Tap drift evenly all round to avoid cracking segments. Discard unserviceable segments.
- b. Vibrapen serial number of mating case and appropriate location numbers onto new segments which replace unserviceable segments.

NOTE

Duct segments that are part of rear turbine case and duct set shall be machined in case assembly. Duct segments that are part of rear turbine support and duct set shall be machined in PWA 57776 fixture.

- c. Install new and serviceable segments into PWA 57776 fixture for machining per paragraph 6.
- d. Machine duct segments per paragraph 6.

NOTE

During machining operation some segments will not clean up over entire surface. Grinding wheel contact is required on at least 2/3 of the total surface area of all 20 duct segments and on at least 1/4 of surface area of any segment. Final machined dimensions shall be within those shown in figure 2.

- e. Remove, deburr, clean, and inspect duct segments per paragraph 6.
- f. Re-install duct segments and steam clean case and duct set per paragraph 6.

8. REAR TURBINE CASE ASSEMBLY (TYPICAL PN 4079211) - REPAIR

(See Table 1.)

NOTE

Vendor repair procedures listed in Qualified Repair Source List (QSRSL) shall be kept current by incorporating all T.O. changes that affect repaired part. If vendor procedure requires revision to comply with T.O. changes, or if vendor wished to revise a procedure, then vendor shall notify SA-ALC/LPFE of need for revision. SA-ALC/LPFE will authorize Pratt & Whitney to coordinate directly with the vendor for review and update of procedure/revision listed in QSRSL.

- a. This is a Proprietary Repair, refer to T.O. 2J-F100-53-1, WP 604 00, for Qualified Repair Source Listing (QSRSL). Repair task codes are identified in table 1.

Rear Turbine Case Assembly - Task Codes

Task Codes	Condition
JGDFGAM	Aft end damage
JGDFGAN	Diameter AM damage
JGDFGAP	Diameter AS damage
JGDFGAQ	Diameter B damage
JGDFGAR	Diameter G damage
JGDFGAS	Diameter J damage
JGDFGAT	Flange AA damage
JGDFGAU	Flange AC damage
JGDFGAV	Flange AD lug/standup damage
JGDFGAW	Flange AE damage
JGDFGAX	Flange AH lug/standup damage
JGDFGAY	Instrumentation boss crack

WORK PACKAGE

TECHNICAL PROCEDURES

RING ASSEMBLY - AIR SEALING, TURBINE, THIRD STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	0				
4 Blank	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Grinding, Blending, Lapping and Buffing General - - - - -	WP 091 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for inspection of the 3rd stage turbine air sealing ring assembly.

2. THIRD STAGE TURBINE AIR SEALING RING ASSEMBLY - BLEND REPAIR.

- a. Blending requirements are as follows:

- (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
- (2) Surface finish of all blends shall be as smooth or smoother than original finish.

- (3) Refer to T.O. 2J-F100-53-1, WP 091 00 procedures for blending.

- b. Blend repair nicks, dents, and scratches in air sealing ring to within serviceable limits as follows:

- (1) Use fine stone.
- (2) Remove raised metal.

- c. Fluorescent penetrant inspect all blend repairs per T.O. 2J-F100-9. No cracks allowed.

WORK PACKAGE

TECHNICAL PROCEDURES

VANE - TURBINE STATOR, THIRD STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 8					0

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-56-1
Painting, Touch-up, Turbine Blades or Vanes Coated with PWA 47 or PWA 73, Using SermeTel J Aluminum-Silicon Slurry (PWA 596) (SPOP 159) - - - - -	SWP 097 12

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 3rd stage turbine stator vanes.

**2. THIRD STAGE TURBINE STATOR VANES -
TEMPERATURE PROBE HOLE CLEANING.**

(See Figure 1.)

NOTE

Use this procedure to remove accumulated deposits only. Do not try to remove broken probes by using this procedure.

- a. Select a No. 41 (0.096 inch) drill long enough to reach the bottom of probe hole. (Minimum length at least 2.000 inches.)

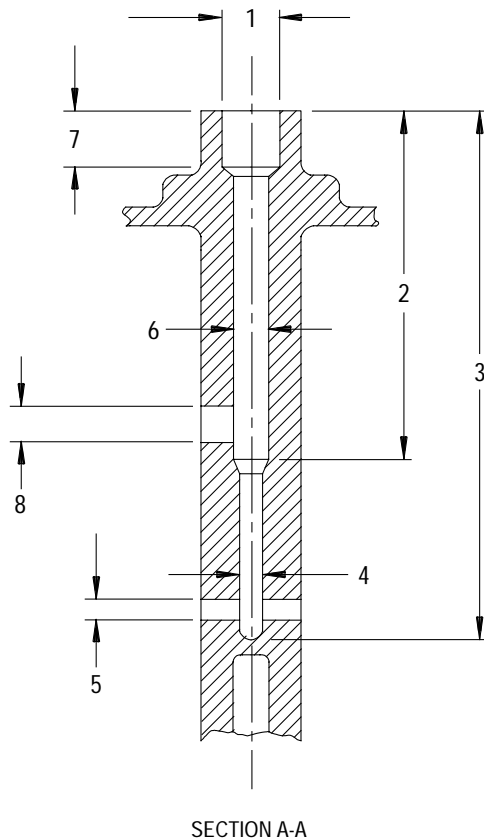
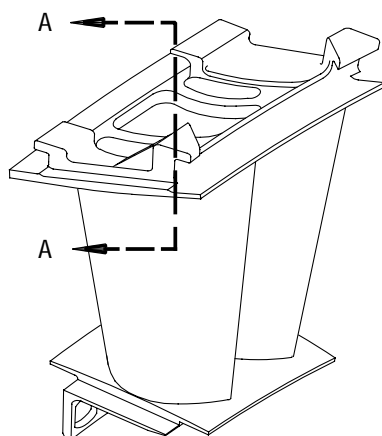


Do not damage vane parent material during reaming. Reject vane if parent material is damaged.

- b. Hand-ream probe hole with drill until drill turns easily.
(See figure 1.)
- c. Clean probe hole using shop air.

REF DIMENSIONS

1. 0.204 - 0.206 INCH DIAMETER
2. 1.223 - 1.353 INCHES
3. 1.854 - 1.894 INCHES
4. 0.098 - 0.104 INCH DIAMETER
5. 0.098 - 0.104 INCH DIAMETER
6. 0.127 - 0.133 INCH DIAMETER
7. 0.290 - 0.310 INCHES
8. 0.127 - 0.133 INCH DIAMETER



JJ261 (37X2)

Figure 1. Third Stage Turbine Stator Vanes - Temperature Probe Hole Cleaning

**3. THIRD STAGE TURBINE STATOR VANES -
BLEND REPAIR.**

(See Figure 2.)

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend unless otherwise specified.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable nicks and dents in leading and trailing edges as follows (See figure 2.):
 - (1) Use fine stone.
 - (2) Remove raised metal and sharp edges.
 - (3) Blend damage up to 0.100 inch in depth in trailing edge, except platform to airfoil radius 0.020 inch depth in platform radius, 0.025 inch depth in leading edge with maximum of three blends in leading or trailing edges.

- c. Blend repair unserviceable nicks and dents in airfoil as follows:

- (1) Use fine stone.
- (2) Remove raised metal and sharp edges.
- (3) Blend damage up to 0.010 inch depth (airfoil shall not be reduced by more than 0.010 inch).
- (4) Maximum damage diameter shall be 0.400 inch diameter and a maximum of four areas per square inch.
- (5) Maximum damage areas per airfoil shall be seven.

- d. Blend repair borescope hole cracks up to 0.030 inch maximum length as follows:

- (1) Use fine stone.

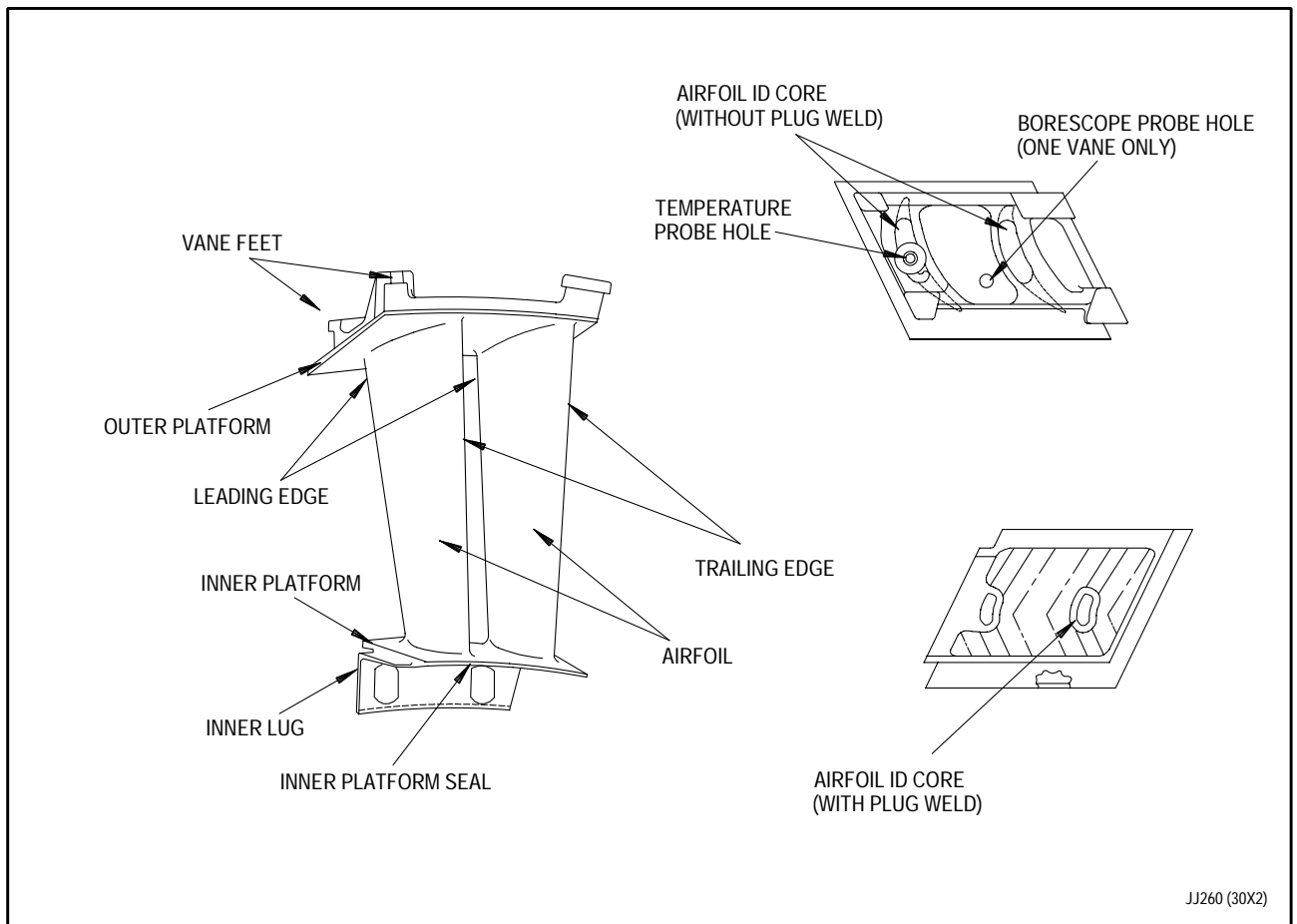


Figure 2. Third Stage Turbine Stator Vanes - Blend Repair

NOTE

- Remove material in manner which eliminates crack by ovalizing hole.
 - Do not blend into airfoil/platform radius.
 - (2) Remove minimum material required (up to 0.030 inch length) to eliminate crack, but enough to maintain smooth rounded contour. Maximum hole diameter allowed after blend is 0.405 inch in one place only.
 - (3) Multiple cracks may be blended provided the sum of all blend depths required to eliminate cracks does not exceed 0.030 inch. Average hole diameter of multiple blend locations may not exceed 0.390 inch.
- e. Blend repair inner platform seal crack as follows:
- (1) Use fine stone.
 - (2) Blend to remove crack up to 0.100 inch length.
 - (3) Remove raised metal and sharp edges.
 - (4) Maximum of 1 blend per vane permitted.

- f. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9. No cracks allowed.

4. COATING TOUCH-UP.

NOTE

- Maximum of three areas per airfoil may be repaired using this procedure.
- Leading edge, trailing edge, inner platform to airfoil radius, and outer platform to airfoil radius, or any combination thereof may be included in any one repair, and shall not exceed 0.500 inch in length. Vanes exceeding this limit require complete replacement of coating.
- Remaining areas are not restricted dimensionally provided a crack and void free coating can be applied.
 - a. Touch-up coating with PWA 596. Refer to T.O. 2J-F100-53-1, SWP 097 12 (SPOP 159).
 - b. Precipitation heat treat vanes in argon, hydrogen, or air at 1586° to 1615°F (863° to 879°C) for 12 hours. Air cool to room temperature.

WORK PACKAGE

TECHNICAL PROCEDURES

VANE - TURBINE STATOR, FOURTH STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 5	0	6 Blank	0		

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 4th stage turbine stator vanes.

**2. FOURTH STAGE TURBINE STATOR VANES -
BLEND REPAIR.**

(See Figure 1.)

a. Blending requirements are as follows:

- (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
- (2) Surface finish of all blends shall be as smooth or smoother than original finish.

b. Blend repair unserviceable nicks and dents in vane leading and trailing edges and airfoil as follows (See figure 1.):

- (1) Use fine stone.
- (2) Remove raised metal as required.

(3) Repair leading and trailing edge damage up to 0.100 inch depth (except in platform airfoil radius) and up to 0.020 inch depth in platform airfoil radius with a maximum of three blends per leading or trailing edge.

(4) Repair airfoil damage up to 0.010 inch depth, 0.400 inch diameter. Four areas per square inch and seven areas per airfoil.

c. Blend repair inner lug damage as follows:

- (1) Use fine stone.
- (2) Remove raised metal as required.

d. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9.

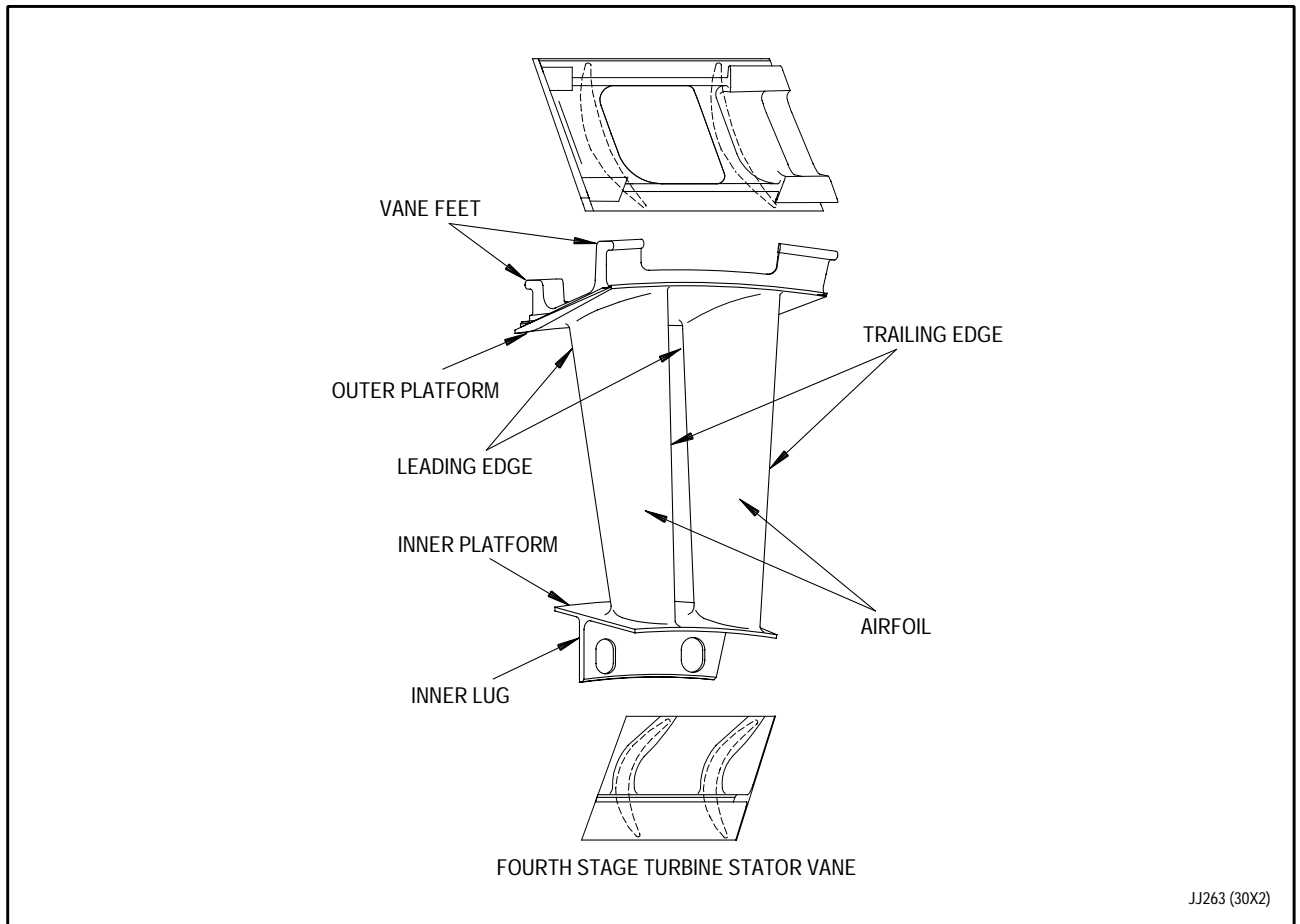


Figure 1. Fourth Stage Turbine Stator Vanes - Blend Repair

WORK PACKAGE

TECHNICAL PROCEDURES

RING ASSEMBLY - AIR SEALING, TURBINE, THIRD STAGE (INNER) -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	19	5 Added	19	6 Blank Added	19
3 - 4	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Qualified Repair Source List (QRS�) Fan Drive Turbine Module - - - - -	WP 605 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 3rd stage (inner) turbine air sealing ring assembly.

2. THIRD STAGE (INNER) TURBINE AIR SEALING RING ASSEMBLY - BLEND REPAIR.

(See Figure 1.)

a. Blending requirements:

- (1) Blending shall extend outward from center of damage a distance of 15 times depth of damage.
- (2) Maximum blend depth shall not exceed 0.005 inch.
- (3) Surface finish after blending shall be as smooth or smoother than original finish.

b. Hand blend nicks, dents, scratches, and corrosion damage on air sealing ring outer surface, using fine stone and crocus cloth. Remove any raised metal. Blending not permitted in other areas or on honeycomb. (See figure 1.)

c. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9. No cracks allowed.

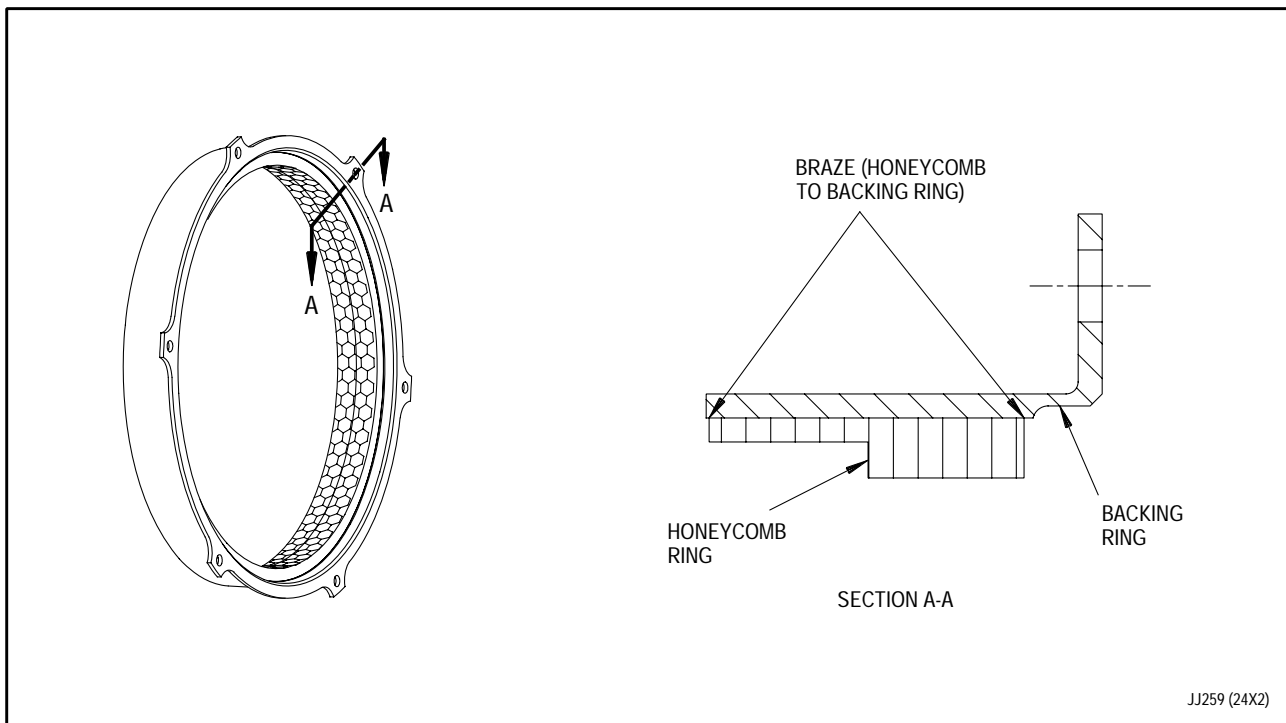


Figure 1. Third Stage (Inner) Turbine Air Sealing Ring Assembly - Blend Repair

3. THIRD STAGE (INNER) TURBINE AIR SEALING RING ASSEMBLY - HONEYCOMB REPLACEMENT

NOTE

Vendor repair procedures referenced in Qualified Repair Source List (QRSL) must be kept current by incorporation of all T.O. changes that affect repair part. If vendor procedure does not incorporate T.O. changes, vendor must submit a procedure revision to SA-ALC/LPFE for review and update procedure and revision date in the QRSL.

- a. This repair procedure is proprietary and consists of the following generic steps. Repair for replacing honeycomb may be performed only by qualified repair sources identified in the QRSL. Refer to T.O. 2J-F100-53-1, WP 605 00.

- (1) Inspect.
- (2) Remove honeycomb.
- (3) Re-install honeycomb.
- (4) Finish machine honeycomb.
- (5) Inspect.

WORK PACKAGE**TECHNICAL PROCEDURES****RING ASSEMBLY - AIR SEALING SEGMENT, TURBINE, FOURTH STAGE -****REPAIR****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	0				
4 Blank	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Grinding, Blending, Lapping and Buffing General - - - - -	WP 091 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 4th stage turbine air sealing ring segment assembly.

2. FOURTH STAGE TURBINE AIR SEALING RING ASSEMBLY - BLEND REPAIR.

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.

- (2) Surface finish of all blends shall be as smooth or smoother than original finish.

- (3) Refer to T.O. 2J-F100-53-1, WP 091 00 procedures for blending.

- b. Blend repair nicks, dents, and scratches in air sealing ring which are within serviceable limits as follows:

- (1) Use fine stone.

- (2) Remove raised metal.

- c. Fluorescent penetrant inspect all blend repairs per T.O. 2J-F100-9. No cracks allowed.

WORK PACKAGE**TECHNICAL PROCEDURES****AIR SEAL, TURBINE, THIRD AND FOURTH STAGES —****REPAIR****EFFECTIVITY: F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	30	4 - 5	27	7 Added	30
2	27	6	30	8 Blank Added	30
3	30				

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Depot Introduction and General Information - - - - -	T.O. 2J-F100-53-1
General Repair Procedures - Grinding, Blending, Lapping, Buffing, and Peening - - - - -	WP 091 00
Depot Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Air Seal, Turbine, Third Stage - Inspection - - - - -	WP 310 00
Air Seal, Turbine, Fourth Stage - Inspection - - - - -	WP 320 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

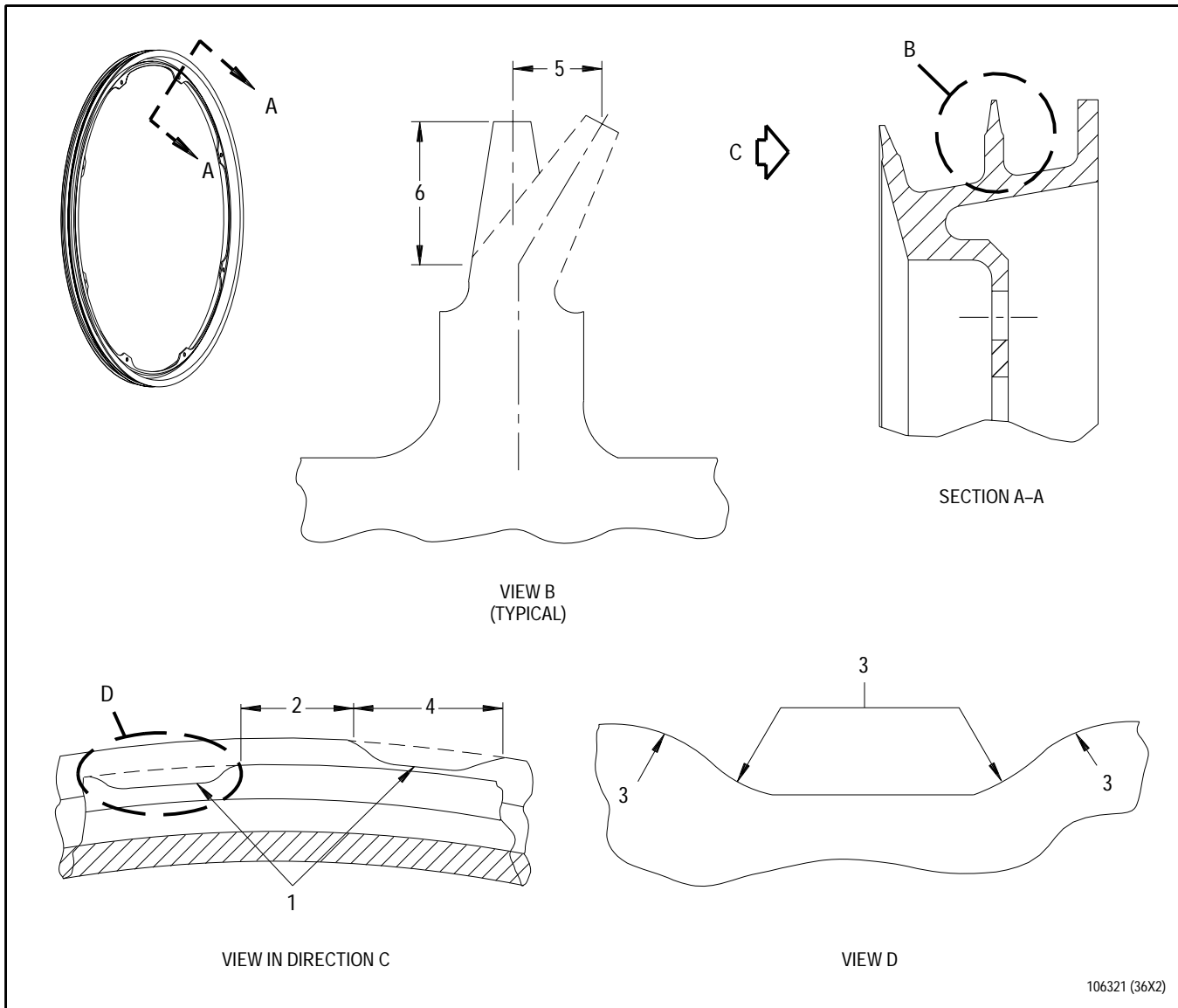
- a. This work package contains instructions for repair and rework of 3rd and 4th stage air seals.

2. AIR SEAL, TURBINE, THIRD AND FOURTH STAGES - KNIFE EDGE BLEND REPAIR

(See Figures 1 and 2.)

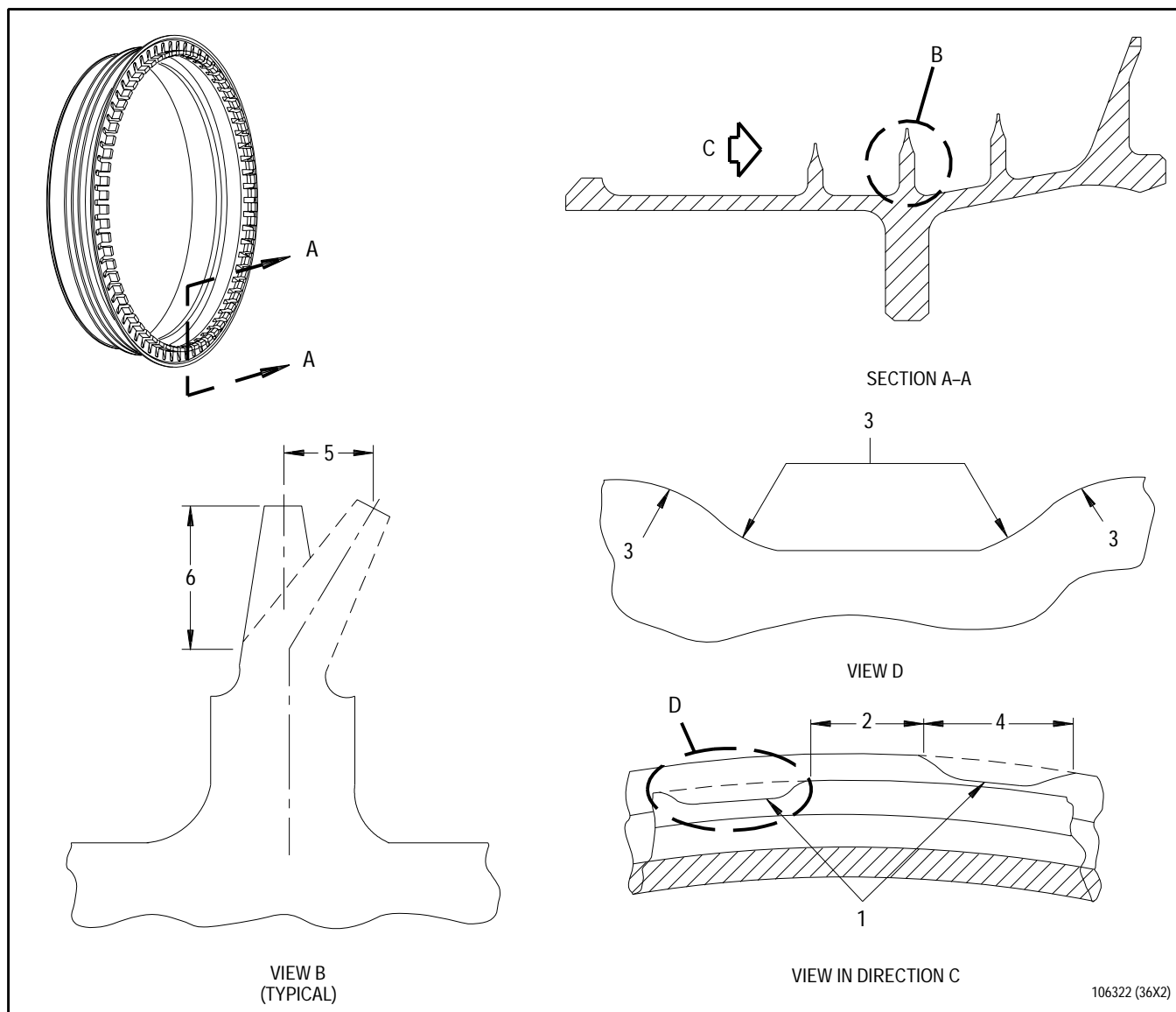
NOTE

- Do not attempt to straighten knife edge air seals.
- Knife edge blending repairs are to be completed after aluminum oxide coating is removed. Aluminum oxide coating must be reapplied after blend repair is complete.
- a. Blend all damage using fine files and stones. See figure 1 for 3rd stage turbine air seal and figure 2 for 4th stage turbine air seal. Refer to T.O. 2J-F100-53-1, WP 091 00. Remove all pickup and raised metal. Blends must meet the following limits:
 - (1) Blending is limited to one continuous inch on any one knife edge or two total inches of noncontinuous blends per knife edge.
 - (2) Blending is limited to three total inches of noncontinuous blends for all knife edges.
 - (3) Noncontinuous blends must be separated by minimum of one inch of unblended knife edge. One inch separation required for blends adjacent to bend with displacement from radial center plane greater than 0.010 inch but less than 0.050 inch.
 - (4) Maximum blend depth is 0.045 inch.
 - (5) Each blended area must have 0.500 inch minimum radius at each end of blend and 0.500 inch transition radius into unblended material.
 - (6) Blended areas on two or more knife edges must be separated by minimum of one inch of unblended area.
- b. Blend must be smooth and continuous with aspect ratio (length to depth) equal to 14 to 1 or greater.
- c. Surface finish of blends must be smooth as, or smoother than adjacent nongrit blasted surfaces.
- d. Fluorescent penetrant inspect per T.O. 2-1-111, SPOP 84. Visually inspect indications using 10X magnification glass under white light. No cracks allowed.
- e. Eddy current inspect knife edges per WP 310 00 for 3rd stage turbine air seal and WP 320 00 for 4th stage turbine air seal.



1. Example of blended area (all knife edges)
2. 1.000 inch minimum between blends on same or adjacent knife edges
3. 0.500 inch minimum radius, all locations
4. 1.00 inch maximum blend length
5. Any amount of bending is reparable providing final blend meets maximum allowable blend depth (6) and blend length (4) requirements.
6. 0.045 inch maximum blend depth. Knife edges are not serviceable or reparable if blends exceed depth limit.

Figure 1. Third Stage Turbine Air Seal - Knife Edge Blend Repair



1. Example of blended area (all knife edges)
2. 1.000 inch minimum between blends on same or adjacent knife edges
3. 0.500 inch minimum radius, all locations
4. 1.00 inch maximum blend length
5. Any amount of bending is reparable providing final blend meets maximum allowable blend depth (6) and blend length (4) requirements.
6. 0.045 inch maximum blend depth. Knife edges are not serviceable or reparable if blends exceed depth limit.

Figure 2. Fourth Stage Turbine Air Seal - Knife Edge Blend Repair

3. AIR SEAL, TURBINE, THIRD AND FOURTH STAGES - KNIFE EDGE COATING REPAIR.

NOTE

Vendor repair procedures listed in qualified repair source list (QRSL) shall be kept current by incorporating all T.O. changes that affect repaired part. If vendor procedure requires revision to comply with T.O. changes, or if vendor desires to revise procedure, then vendor must notify SA-ALC/LPFE of need for revision. SA-ALC/LPFE will authorize Pratt & Whitney to coordinate directly with vendor for review and update of procedure and revision listed in QRSL.

- a. Perform proprietary worn knife edge coating repair as follows:

- (1) Proprietary repairs for following distress modes may be performed only by qualified repair sources identified in QRSL. Refer to T.O. 2J-F100-53-1, WP 605 00.

- JGDFGZB Worn knife edge coating

4. AIR SEAL, TURBINE, THIRD STAGE (AREAS OTHER THAN KNIFE EDGES) - BLEND REPAIR

(See Figure 3.)

- a. Blending requirements for surface R are as follows:

- (1) Hand blend damage using fine stone, or crocus cloth. Remove all raised material.
- (2) Maximum allowable blend depth is 0.002 inches.
- (3) Surface R must be minimum distance of 0.346 inches from surface A.
- (4) All blending shall extend distance of at least 15 times depth of damage from center of blend.
- (5) Surface finish of blends must be smooth as, or smoother than adjacent unblended surfaces.

- b. Blending requirements are as follows (for areas other than knife edges, scallops and surface R):

- (1) Hand blend damage using fine stone, or crocus cloth. Remove all raised material.
- (2) Maximum allowable blend depth is 0.010 inches.
- (3) All blending shall extend distance of at least 15 times depth of damage from center of blend.
- (4) Surface finish of blends must be smooth as, or smoother than adjacent unblended surfaces.

- c. All blend repairs shall be fluorescent penetrant inspected per SFPS-M, Ultrahigh sensitivity FPI. Refer T.O. 2-1-111, SPOP 84. No cracks allowed.

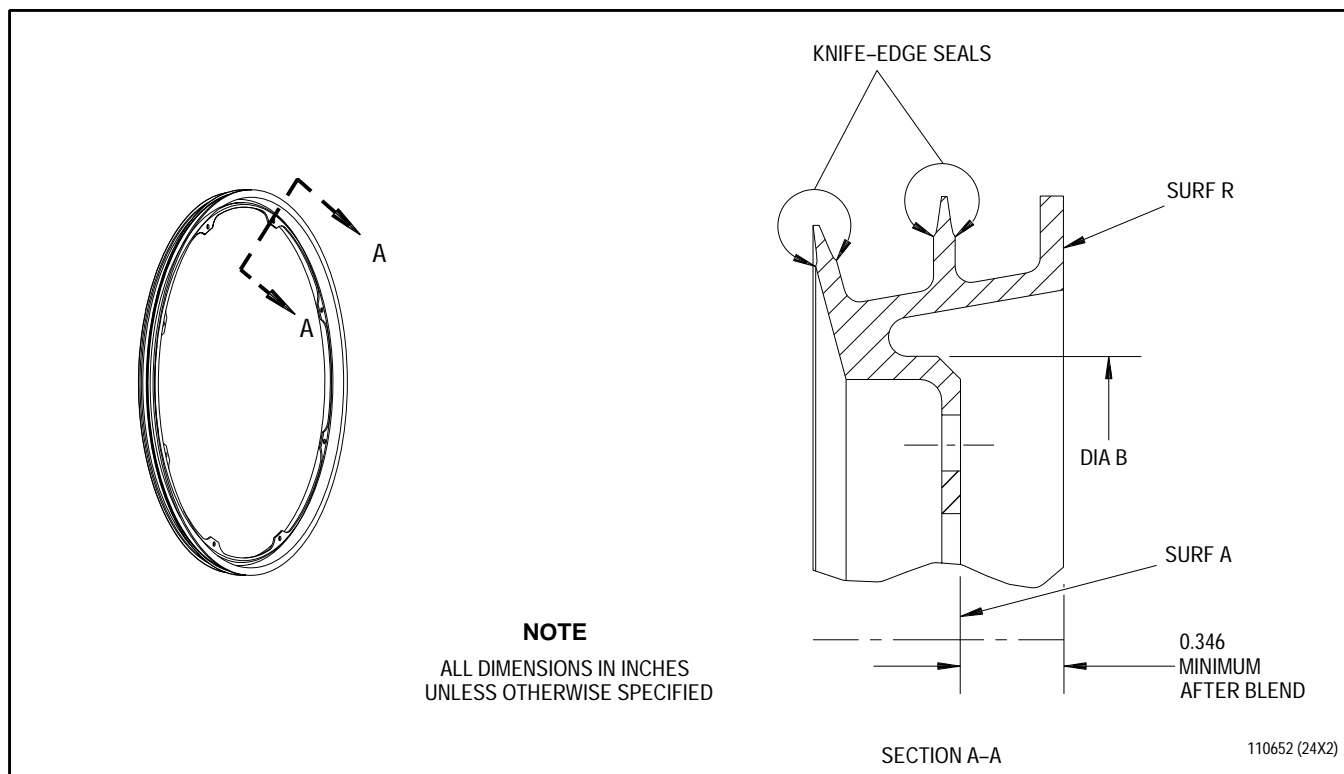


Figure 3. Air Seal, Turbine, Third Stage (Areas Other Than Knife Edges) - Blend Repair

WORK PACKAGE

TECHNICAL PROCEDURES

DISK - TURBINE, THIRD STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	18	3 - 4	0	5 - 6	18

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Disk - Turbine, Third Stage - Inspection - - - - -	WP 312 00
Rotor and Stator Assembly, Front Compressor Drive Turbine - Dynamic Balancing Check - - - - -	WP 613 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
CLOTH, ABRASIVE CROCUS	P-C-458

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 3rd stage turbine disk.

2. THIRD STAGE TURBINE DISK - BLEND REPAIR.

(See Figure 1.)



Under no circumstances shall snap diameter of disk be changed. Evaluation of disk growth would be impaired. Do not blend into blade slots.

- a. Blending requirements are as follows (See figure 1.):
- (1) Blend repair disks by hand blending using blending stones and crocus cloth.
 - (2) All local blending shall extend to a distance of at least 15 times the depth of the damage with damaged area being the center of the blend.
 - (3) Surface finish of all blends shall be as smooth or smoother than original finish.
 - (4) Remove raised metal.

- b. Blend unserviceable nicks and dents as follows:

- (1) Blend up to 0.005 inch maximum depth.
- (2) Remove sharp edges.
- (3) Do not blend into blade slots.

- c. Blend unserviceable scratches as follows:

- (1) Blend up to 0.005 inch maximum depth and a 1.000 inch maximum length.
- (2) Remove sharp edges.
- (3) Do not blend into blade slots.

- d. Blend unserviceable corrosion not within 0.100 inch of disk blade slots as follows:

- (1) Blend up to 0.002 inch maximum depth and a maximum area of two square inches.
- (2) Hand polish using blending stones and crocus cloth.

- e. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9. No cracks allowed.

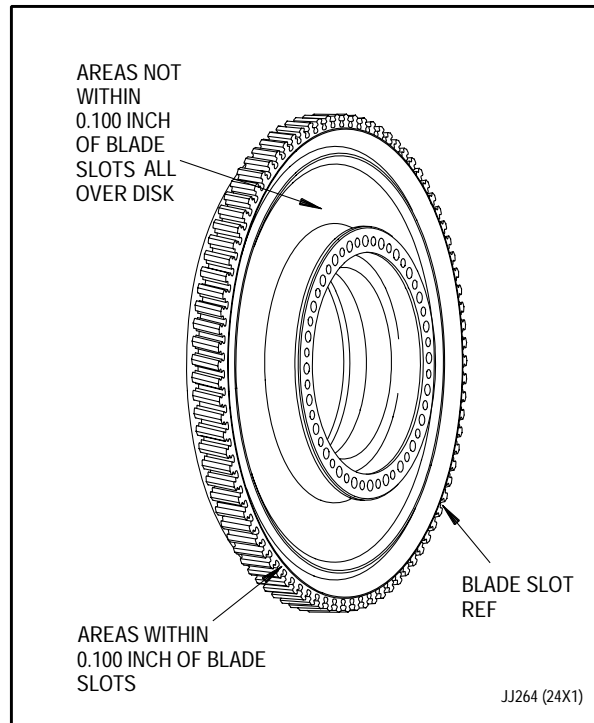


Figure 1. Third Stage Turbine Disk - Blend Repair

3. THIRD STAGE TURBINE DISK - BALANCE WEIGHT FLANGE TANG REMOVAL.

(See Figure 2.)

NOTE

Number of tangs that may be removed by this procedure is not limited by structural integrity, but removing several tangs from single disk or removing tangs from several disks in rotor and stator assembly could make balancing the assembly difficult.

- a. Remove no more than six tangs, and no two adjacent tangs.

- b. Do not attempt to straighten bent flange tangs that are bent more than 0.020 inch out of plane as measured from tip of tang.
- c. Remove bent tangs by blending to remove at least 50% of rivet hole. Maximum material removal is limited to 0.040 inch above bottom of scallop. See figure 2.
- d. Fluorescent penetrant inspect per WP 312 00.
- e. Dynamic balance rotor and stator assembly per WP 613 00.

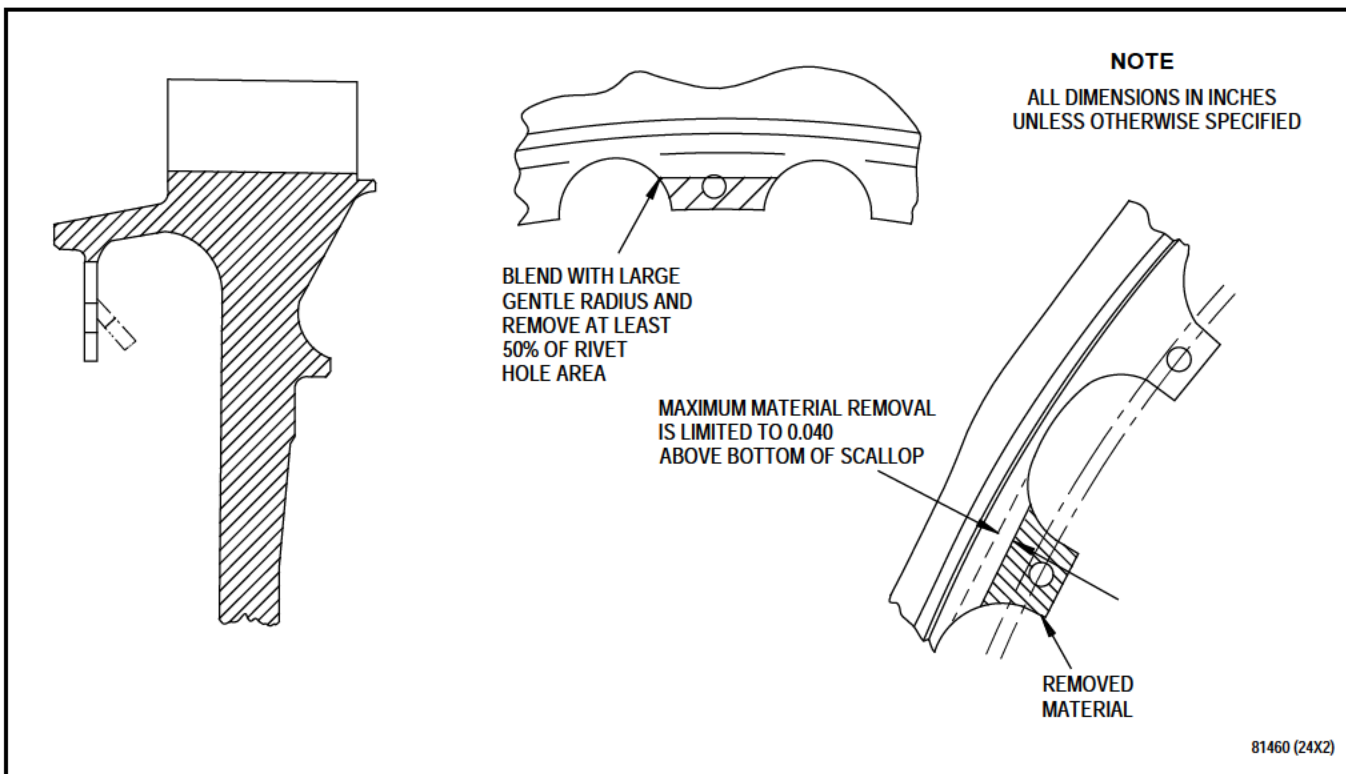


Figure 2. Third Stage Turbine Disk - Balance Weight Flange Tang Removal For Tang Bent Inboard Of Rivet Hole

WORK PACKAGE

TECHNICAL PROCEDURES

BLADE, TURBINE ROTOR, THIRD STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 8					0

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Disk, Blades, Air Sealing Ring, and Air Seal, Third Stage Turbine, Hub Assembly, Turbine Rear, and Tierod, Turbine - Assembly - - - - -	WP 603 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Compound, polishing (PMC 3022)	Lea Grade L

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 3rd stage turbine rotor blades.

2. THIRD STAGE TURBINE ROTOR BLADES - BLEND REPAIR.

(See Figures 1 and 2.)

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
 - (3) Maintain airfoil contours (example: leading edge radius).
- b. Blend repair unserviceable nicks and dents in rotor blades leading and trailing edge cracks. (See figure 1.) Blend as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal as required.
 - (3) Fluorescent penetrant inspect after blend. Refer to T.O. 2J-F100-9. No cracks allowed.
 - (4) Limits.

Leading Edge Area

Blend Limit

- | | |
|---|---|
| A | Three blends up to 0.035 inch deep provided blends are not within 0.500 inch of each other. |
| B | No nicks, dents, or blends allowed. |

Trailing Edge Area

Blend Limit

- | | |
|---|---|
| A | Three blends up to 0.035 inch deep provided blends are not within 0.500 inch of each other. |
| B | No nicks, dents, or blends allowed. |

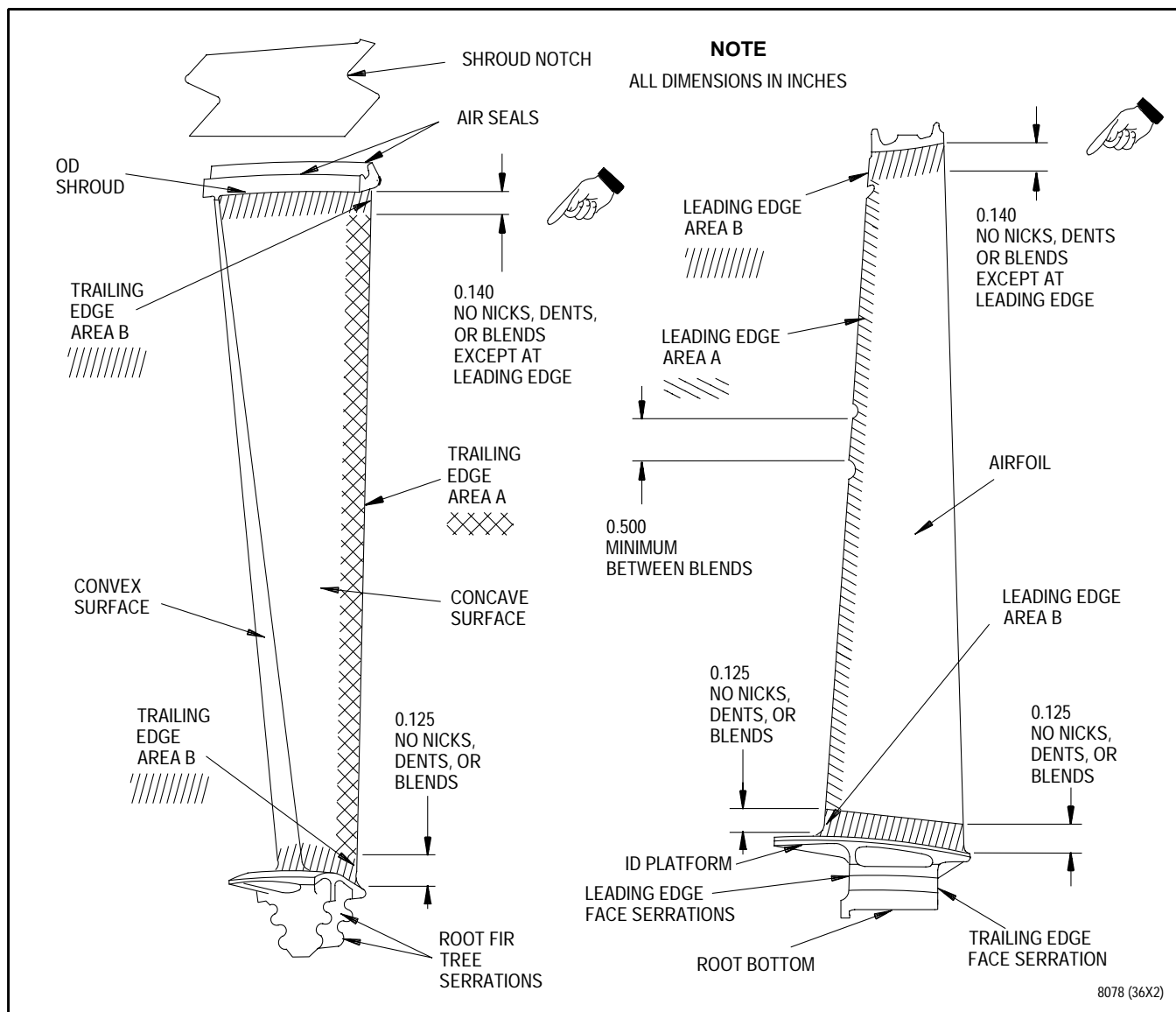


Figure 1. Third Stage Turbine Rotor Blades - Blend Repair

- c. Blend repair unserviceable nicks and dents in blade OD shroud (except on knife-edge seals) as follows:
 - (1) Blend damage having sharp edges to a maximum of 0.015 inch deep.
 - (2) No blending in radius permitted.
- d. Blend repair unserviceable bent or damaged air seal knife-edge seals as follows: (See figure 2.)
 - (1) Seal corners may be blended to 0.100 inch radius.
 - (2) Blends on two opposite corners per blade permitted.
- e. Blend repair unserviceable nicks, pits, and dents in ID platform as follows:
 - (1) Blend damage up to 0.020 inch deep and 0.100 inch diameter.
 - (2) Maximum blends six locations.
 - (3) No blending in platform/airfoil radii.
 - (4) No cracks allowed.
- f. Blend repair leading edge rub as follows:
 - (1) Remove all sharp edges.
- g. After all blending proceed as follows:
 - (1) Fluorescent penetrant inspect. Refer to T.O. 2J-F100-9. No cracks allowed.
 - (2) Moment-weigh blades. Refer to WP 603 00.

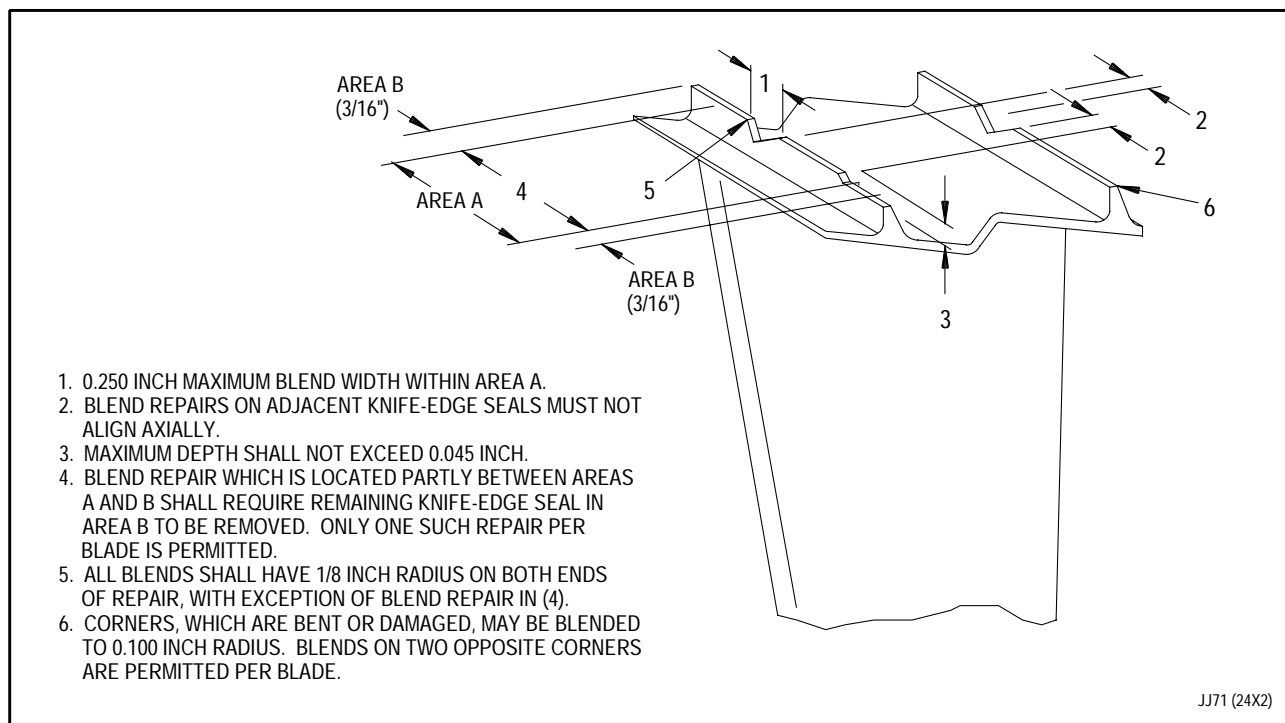


Figure 2. Third Stage Turbine Rotor Blades - Knife-edge Seals Blend Repair

3. THIRD STAGE TURBINE ROTOR BLADES - SHROUD NOTCH BLENDING.

(See Figure 3.)

NOTE

During rework do not cause material to heat beyond temperature which can be touched safely by hand.

- a. Remove cracks from shroud notches in cross hatched area, View C only, by hand filing minimum amount of material, not exceeding limits. (See figure 3.)
- b. Polish reworked areas using cloth wheel with polishing compound, Lea Grade L, or equivalent.

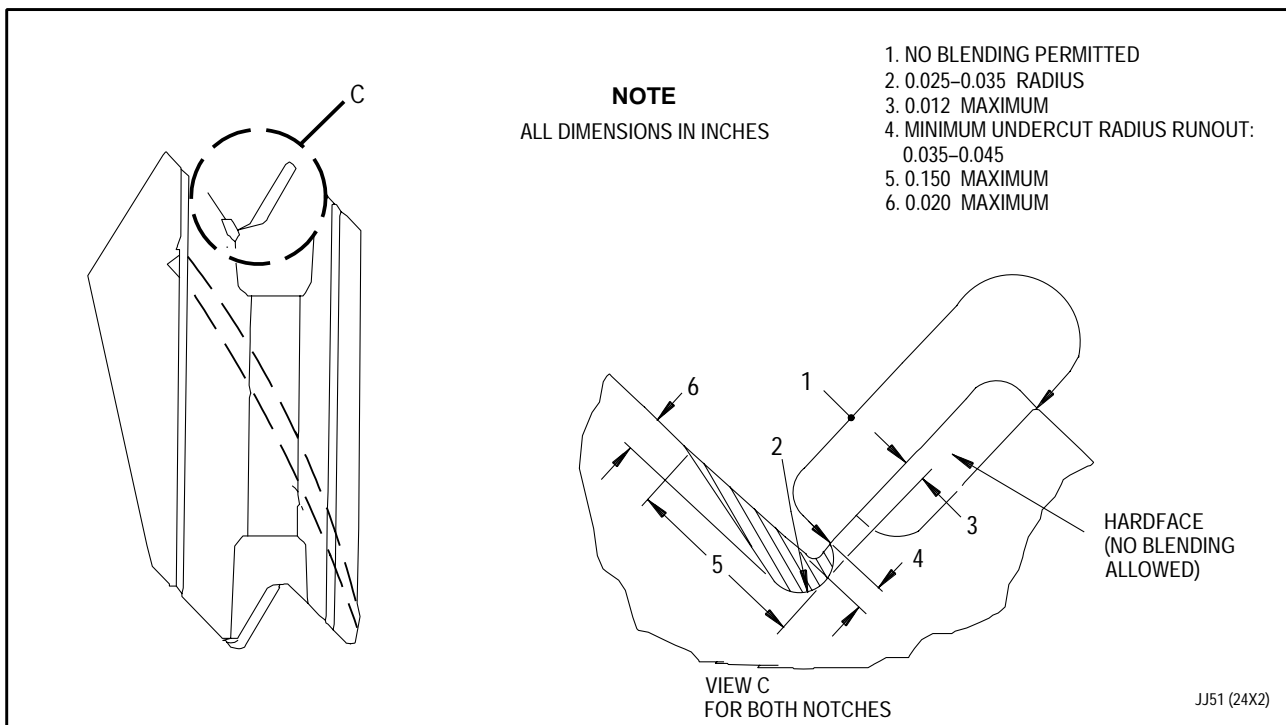


Figure 3. Third Stage Turbine Rotor Blades - Shroud Notch Blending

WORK PACKAGE

TECHNICAL PROCEDURES

BLADE, TURBINE ROTOR, FOURTH STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 7	0	8 Blank	0		

T.O. 2J-F100-53-9

WP 414 00

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Disc and Blades, Fourth Stage Turbine - Assembly - - - - -	WP 605 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Compound, polishing, greaseless, 120 grit (coarse)	Lea Platiclad Grade L
Cloth, abrasive crocus	P-C-458

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 4th stage turbine blades.

2. FOURTH STAGE TURBINE ROTOR BLADES - BLEND REPAIR.

(See Figures 1 and 2.)

- a. Blending requirements are as follows:
 - (1) All local blending shall extend at least 15 times depth of damage from center of blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable nicks and dents in leading and trailing edges (see figure 1) as follows:
 - (1) Use fine stone or crocus cloth.
 - (2) Remove raised metal as required.
 - (3) No cracks allowed.
 - (4) Limits:

Leading Edge Area

Blend Limit

- | | |
|---|--|
| A | Three blends up to 0.050 inch deep |
| C | Minor nicks less than 0.005 inch deep shall be removed by polishing with crocus cloth or fine stone. |
| D | No nicks, dents, or blends. |

Trailing Edge Area

Blend Limit

- | | |
|---|---|
| A | Three blends up to 0.050 inch deep provided blends are not within 0.500 inch of each other. |
| B | No nicks, dents, or blends allowed. |

- c. Blend repair unserviceable nicks and dents in blade OD shroud (except on knife-edge seals) as follows:
 - (1) Blend damage having sharp edges to a maximum of 0.015 inch deep.
 - (2) No blending in radius permitted.

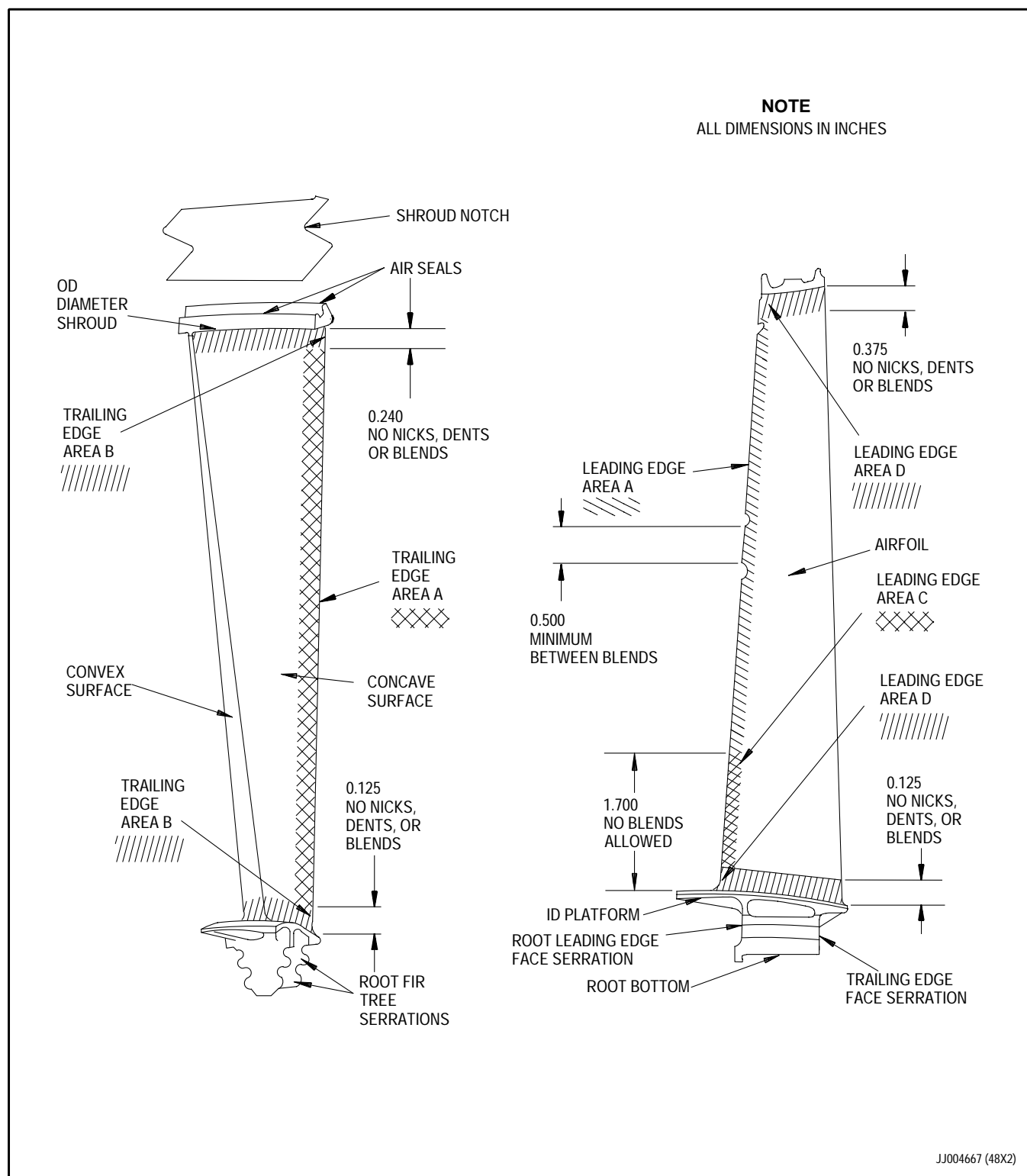


Figure 1. Fourth Stage Turbine Rotor Blades - Repair

- d. Blend repair unserviceable bent or damaged air seal knife-edge seal corners (see figure 2) as follows:
 - (1) Seal corners may be blended to 0.100 inch radius.
 - (2) Blends on two opposite corners per blade permitted.
- e. Blend repair unserviceable nicks, pits, and dents in ID platform (see figure 1) as follows:
 - (1) Blend damage up to 0.020 inch deep and 0.100 inch diameter.
 - (2) Maximum blends six locations.
- (3) No blending in platform or airfoil radii.
- (4) No cracks allowed.
- f. Blend repair unserviceable nicks, pits, dents, and cracks in knife edge seals (see figure 2).
- g. After all blending proceed as follows:
 - (1) Fluorescent penetrant inspect per T.O. 2J-F100-9. No cracks allowed.
 - (2) Moment-weigh blades. Refer to T.O. 2J-F100-53-9, WP 605 00.

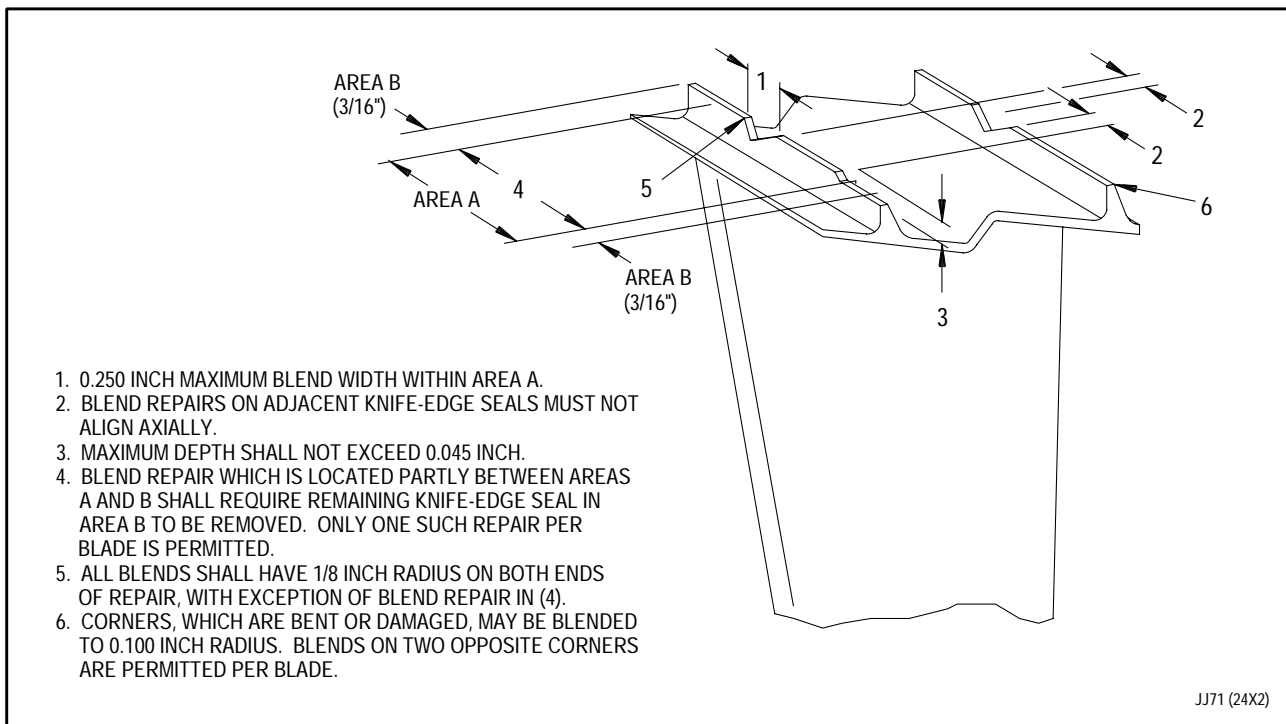


Figure 2. Fourth Stage Turbine Rotor Blades - Knife-Edge Seals Blend Repair

3. FOURTH STAGE TURBINE BLADES - SHROUD NOTCH BLENDING.

(See Figure 3.)

NOTE

During rework do not cause material to heat beyond temperature which can be touched safely by hand.

- a. Remove cracks from shroud notches in cross hatched area, View C only, by hand filing minimum amount of material not exceeding limits. (See figure 3.)

- b. Fluorescent penetrant inspect after blending per T.O. 2J-F100-9. No cracks allowed.

- c. Polish reworked areas using cloth wheel with polishing compound, Lea Grade L, or equivalent.

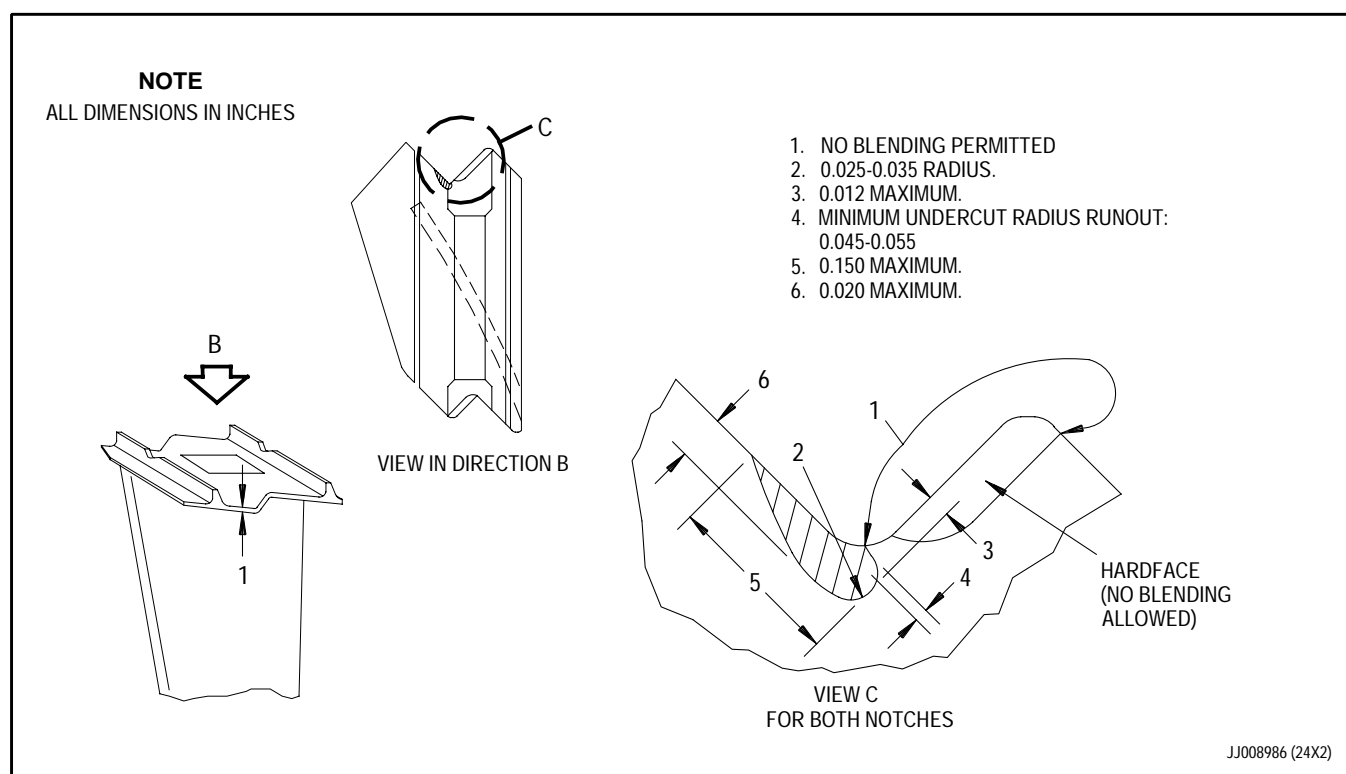


Figure 3. Fourth Stage Turbine Rotor Blades - Shroud Notch Blending

WORK PACKAGE

TECHNICAL PROCEDURES

HUB ASSEMBLY, TURBINE REAR -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 16

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	14	6	14	16 Blank	0
3 - 5	0	7 - 15	0		

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Cleaning, Glass Bead Blast, Wet (SPOP 16) - - - - -	SWP 031 03
Cleaning, Wet Abrasive Blast (SPOP 9) - - - - -	SWP 031 19
Blending, Hole Radius (SPOP 502) - - - - -	SWP 091 04
Peening, Steel Shot (SPOP 501) - - - - -	SWP 091 08
Plating, Nickel, on Stainless Steel, Nickel, or Cobalt (SPOP 26) - - - - -	SWP 092 10
Compound, Antigalling (PWA 36545) Application (SPOP 748) - -	SWP 098 07

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Tape, masking	Scotch No. 484
Compound, antigalling	Everlube 382
PWA 36545	

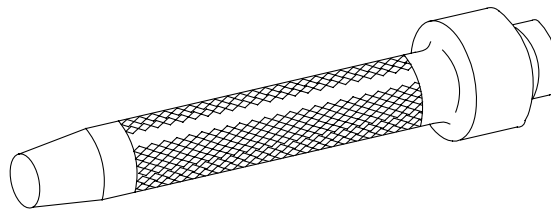
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
5	Turbine Rear Hub Assembly - Headless Shoulder Pin Replacement	
	Drift - - - - -	PWA 51778

ILLUSTRATED SUPPORT EQUIPMENT



PWA 51778 -C

Figure T1. PWA 51778 Drift

1. INTRODUCTION.

- a. This work package contains instructions for the repair of the rear turbine hub assembly. A listing of the repairs included are as follows:

Repair	Paragraph
Antigalling compound application	2
Blend repair	3
Hubs, pitted in areas other than snap diameters or mating surfaces - procedure for processing	4
Headless shoulder pin replacement	5
Third and fourth stage turbine disks snap diameters repair	6
Disks and airseals mating faces repair	7
Forward and rearward inside diameter snap diameters repair	8

2. TURBINE REAR HUB ASSEMBLY - ANTIGALLING COMPOUND APPLICATION.

(See Figure 1.)

- a. Wet abrasive blast area to be treated. Refer to T.O. 2J-F100-53-1, SWP 031 19 (SPOP 9).

- b. Apply PWA 36545 antigalling compound to area. (See figure 1.) Refer to T.O. 2J-F100-53-1, SWP 098 07 (SPOP 748).

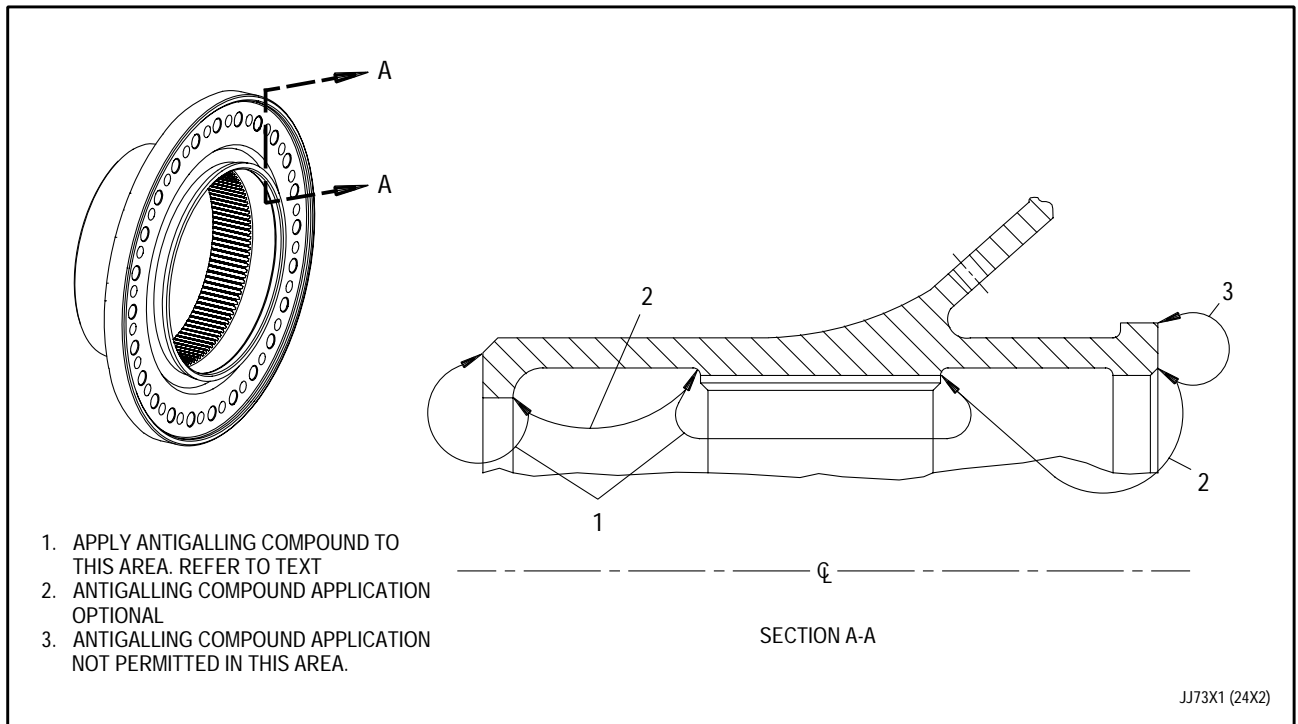


Figure 1. Turbine Rear Hub Assembly - Antigalling Compound Application

3. REAR TURBINE HUB ASSEMBLY - BLEND REPAIR.

(See Figure 2.)

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to a distance of at least 15 times depth of damage from center of blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable nicks, and dents in tierod holes as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal and pickup.
 - (3) Radius blend holes. Refer to T.O. 2J-F100-53-1 SWP 091 04 (SPOP 502) after other repairs have been completed.
 - (4) Shotpeen blend area with intensity 4A to 9A using SAE 170 maximum cast steel shot of hardness 45 Rockwell C minimum or equivalent. Refer to T.O. 2J-F100-53-1, SWP 091 08 (SPOP 501). No masking and no lines of demarcation permitted.

NOTE

Shotpeen not permitted on splines.

- c. Blend repair unserviceable pits, nicks, and dents in splines as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal and pickup.
- d. Blend repair unserviceable scratches, nicks and dings on nut seat and chamfer as follows:
 - (1) Blend damage up to 0.020 inch in depth and 0.005 inch wide.
 - (2) Use fine stone.
 - (3) Remove raised metal and pickup.
 - (4) Shotpeen blend area with intensity 4A to 9A using SAE 170 maximum cast steel shot of hardness 45 Rockwell C minimum or equivalent. Refer to T.O. 2J-F100-53-1, SWP 091 08 (SPOP 501). No masking and no lines of demarcation permitted.
- e. Fluorescent penetrant inspect all blend repairs. Refer to T.O. 2J-F100-9. No cracks allowed.

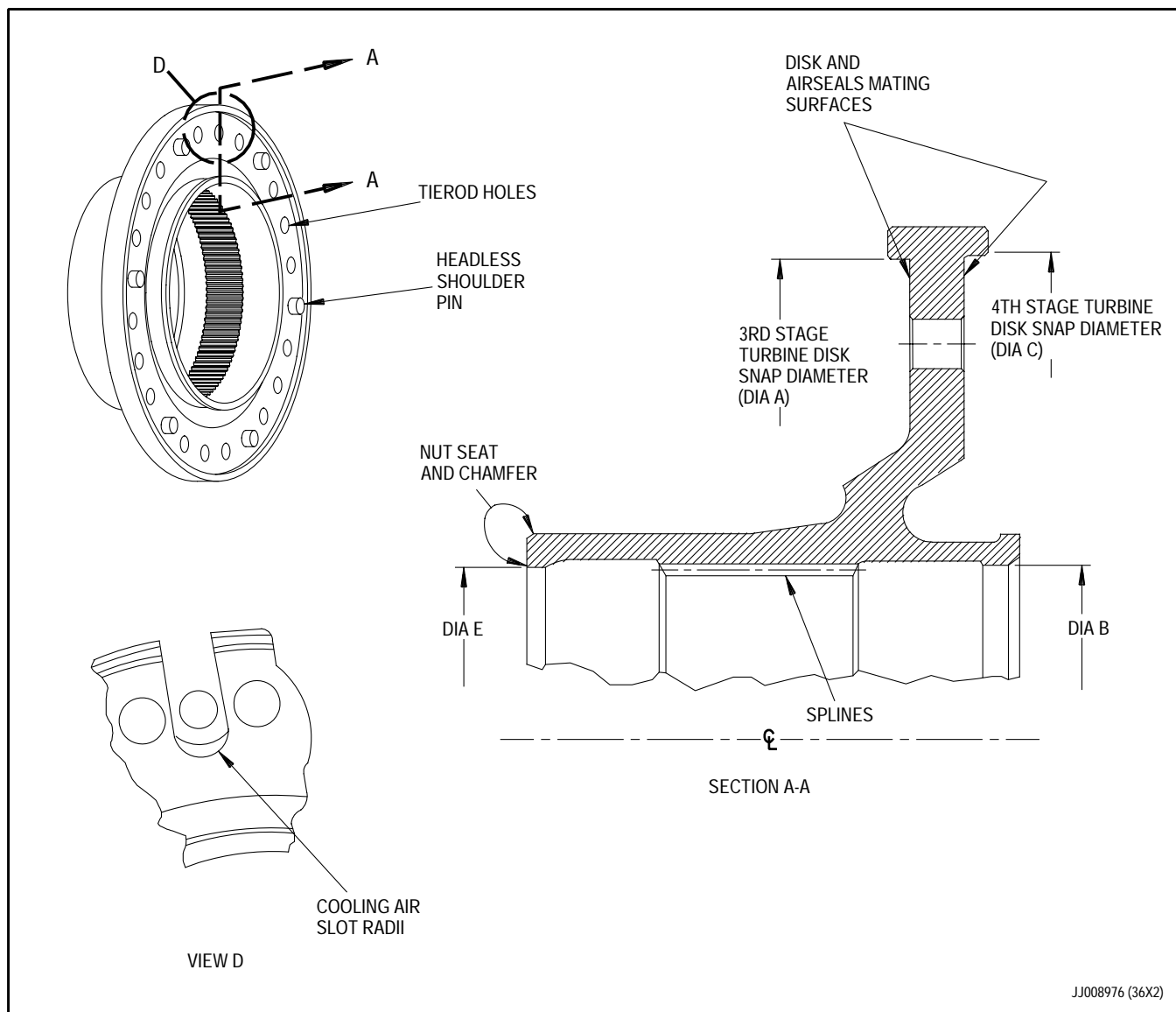


Figure 2. Rear Turbine Hub Assembly - Blend Repair

**4. HUBS, PITTED IN AREAS OTHER THAN
SNAP DIAMETERS OR MATING SURFACES -
PROCEDURE FOR PROCESSING.**

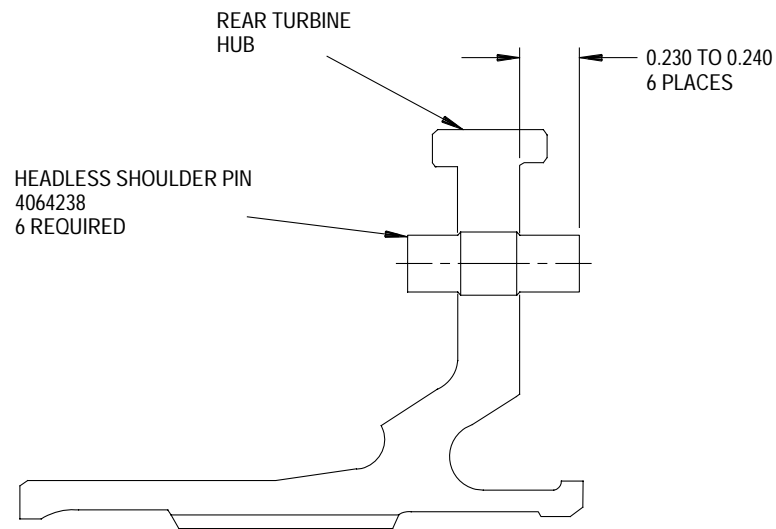
(See figure 2.)

- a. Use Scotch No. 484 tape to mask areas not to be blasted.
- b. Wet glass bead blast hub ID and OD until surfaces are clean.
Refer to T.O. 2J-F100-53-1
SWP 031 03 (SPOP 16).

**5. HEADLESS SHOULDER PIN -
REPLACEMENT.**

(See Figure 3.)

- a. Remove unserviceable pin.
- b. Chill replacement pin.
- c. Use PWA 51778 drift to install replacement pin. (See figure 3.)



JJ008977 (24X2)

Figure 3. Rear Turbine Hub Assembly - Pin Replacement

**6. THIRD AND FOURTH STAGE TURBINE
DISKS - SNAP DIAMETERS REPAIR.**

(See Figure 4.)

NOTE

Verify Diameter B is
5.816 to 5.820 inch diameter.
This repair can not be used if
Diameter B is not within
tolerance.

- a. Remove pins.
- b. Clean up machine worn diameter to dimensions shown. Chemical stripping per T.O. 2J-F100-53-1, SWP 092 10 is permitted to remove existing nickel plate.
- c. Nickel plate areas shown. Refer to T.O. 2J-F100-53-1, SWP 092 10 (SPOP 26).
- d. Finish machine plated areas to dimensions shown. Maintain squareness shown.
- e. Check to ensure final dimension is not exceeded.
- f. Replace pins per paragraph 5.

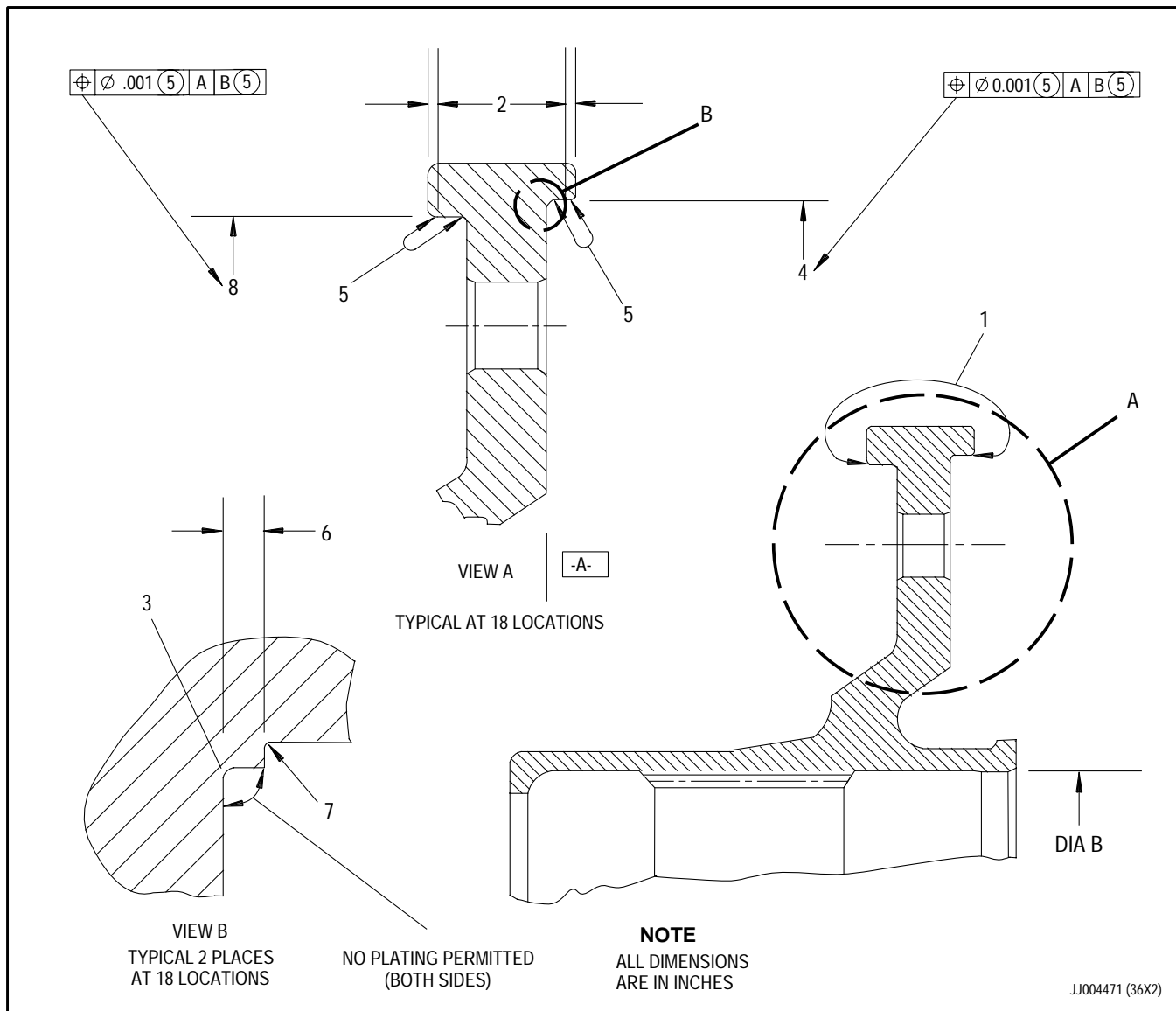


Figure 4. Rear Turbine Hub Assembly - Third and Fourth Stage Turbine Disks Snap Diameter Repairs

Legend to figure 4

1. Electrical contact area
2. Chamfer 0.015 to 0.040 inch by 45° ±5°, 2 places
3. 0.030 to 0.040 inch radius, two places, (ref).
4. Clean up machine to 9.595 to 9.607 inch diameter, hold to minimum. Nickel plate to 9.575 inch diameter. Finish machine to 9.585 to 9.589 inch diameter. True position requirement applies before and after plating. If true position is out of tolerance before plating and not enough material remains to machine, hold for future disposition. If true position is out of tolerance after plating, repeat steps b. through e.
5. Nickel plate repair area. Plating outside this area is permissible, except where noted, provided excess plating is removed.
6. 0.040 to 0.050 inch, two places.
7. 0.030 to 0.040 inch radius, two places, before plating.
8. Clean up machine to 9.505 to 9.517 inch diameter, hold to minimum. Nickel plate to 9.485 inch diameter. Finish machine to 9.495 to 9.499 inch diameter.

7. DISKS AND AIR SEALS - MATING FACES REPAIR.

(See Figure 5.)

NOTE

This repair can not be used if surface is worn or galled.

- a. Remove pins.

NOTE

Surface A must be within dimension 10 and flat within 0.001 inch total, prior to repairing surface B.

- b. Clean up machine worn surface to dimensions shown. Chemical stripping per T.O. 2J-F100-53-1, SWP 092 10 is permitted to remove existing nickel plate.

- c. Mask holes.

- d. Nickel plate area shown. Refer to T.O. 2J-F100-53-1, SWP 092 10.

- e. Finish machine plated areas to dimensions shown. Maintain squareness shown.

- f. Check to ensure final dimension is not exceeded.

- g. Replace pins per paragraph 5.

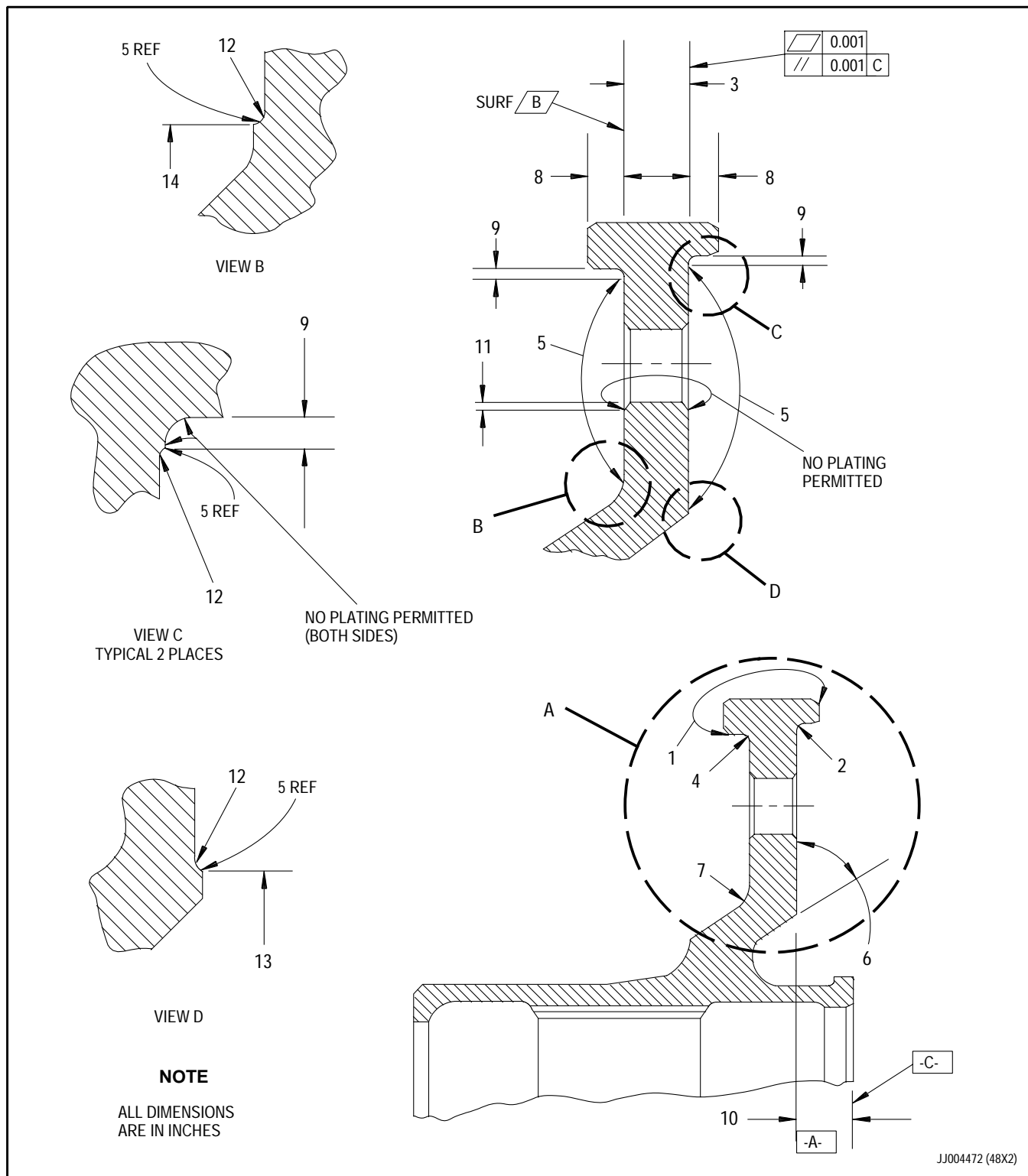


Figure 5. Rear Turbine Hub Assembly - Disks and Air Seals Mating Face - Repair

Legend to figure 5

1. Electrical contact area. No burning pitting or selective attack.
2. 0.030 to 0.040 inch radius.
3. Clean up machine to 0.330 to 0.334 inch, hold to maximum value. Plate 0.015 inch thick maximum. Finish machine to 0.337 to 0.341 inch.
4. 0.030 to 0.040 inch radius.
5. Nickel plate repair area. Plating outside this area is permissible, except where noted, provided excess plating is removed.
6. $35^{\circ} 0' \pm 0^{\circ} 30'$
7. 0.172 to 0.203 inch radius (ref)
8. 0.145 to 0.155 inch, 2 places, after plating
9. 0.040 to 0.050 inch, both sides
10. Clean up machine worn surface 0.385 to 0.389 inch, removing minimum amount of material. Plate 0.015 inch thick maximum. After plating, finish machine 0.378 to 0.382 inch.
11. 0.040 to 0.050 inch, around each hole, both sides
12. 0.030 to 0.040 inch radius, 4 places
13. 7.300 to 7.320 inch diameter
14. 7.480 to 7.500 inch diameter

(See Figure 6.)

Verify Diameter A is
9.585 to 9.589 inch diameter.
This repair can not be used if
Diameter A is not within
tolerance.

- d. Check to ensure final dimensions are not exceeded.



Legend to figure 6

1. Electrical contact area
2. Plate repair area. Plating outside this area is permissible, provided excess plating is removed.
3. Chamfer 0.025 to 0.045 inch x 45° ±5°.
4. Clean up machine worn diameter to 5.838 to 5.826 inch diameter, removing minimum amount of material. Nickel plate to 5.809 to 5.816 inch diameter. Finish machine to 5.816 to 5.820 inch diameter. Diameter B and E must be concentric within 0.001 inch diameter in relation to each other and Diameter A and perpendicular within 0.001 diameter in relation to Surface R after clean up machining. After finish machining, Diameter B and E must be within 0.0005 inch diameter in relation to each other and Diameter A and 0.001 inch diameter concentric in relation to Surface R.
5. Clean up machine worn diameter to 5.585 to 5.571 inch diameter, removing minimum amount of material. Nickel plate to 5.554 to 5.561 inch diameter. Finish machine to 5.563 to 5.565 inch diameter.

WORK PACKAGE

TECHNICAL PROCEDURES

RING ASSEMBLY - AIR SEALING, TURBINE, FOURTH STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 5	29	6 Blank	0		

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures	T.O. 2-1-111
Nondestructive Inspection	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

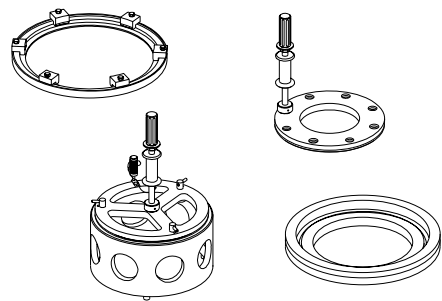
EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Rivet	AN123629	As Required

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
4	FOURTH STAGE TURBINE BRUSH SEAL AND SUPPORT ASSEMBLY - BRUSH REPLACEMENT	
	FIXTURE, BRUSH AND SEAL SUPPORT ASSY 4TH STAGE TURBINE DISK	PWA 57934

ILLUSTRATED SUPPORT EQUIPMENT



PWA 57934 -C

Figure T1. PWA 57934 FIXTURE

1. INTRODUCTION.

- a. This work package contains instructions for repair of 4th stage turbine air sealing ring assembly and fourth stage turbine brush seal and support assembly - brush replacement.

2. FOURTH STAGE TURBINE AIR SEALING RING ASSEMBLY - NUT PLATE REPLACEMENT.

(See Figure 1.)

- a. Grind off upset head of rivet at 2 locations per nut plate.
- b. Remove and discard unserviceable nut plate(2, figure 1) or use if undamaged.
- c. Install serviceable nut plates or install new nut plates using rivets(1). Refer to T.O. 2-1-111.

3. FOURTH STAGE TURBINE AIR SEALING RING ASSEMBLY - BLEND REPAIR.

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable nicks and dents in ring assembly as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal as required.
 - (3) Blend air sealing ring and damper up to 0.020 inch maximum.
- c. Fluorescent penetrant inspect per T.O. 2J-F100-9 after all blending. No cracks allowed.

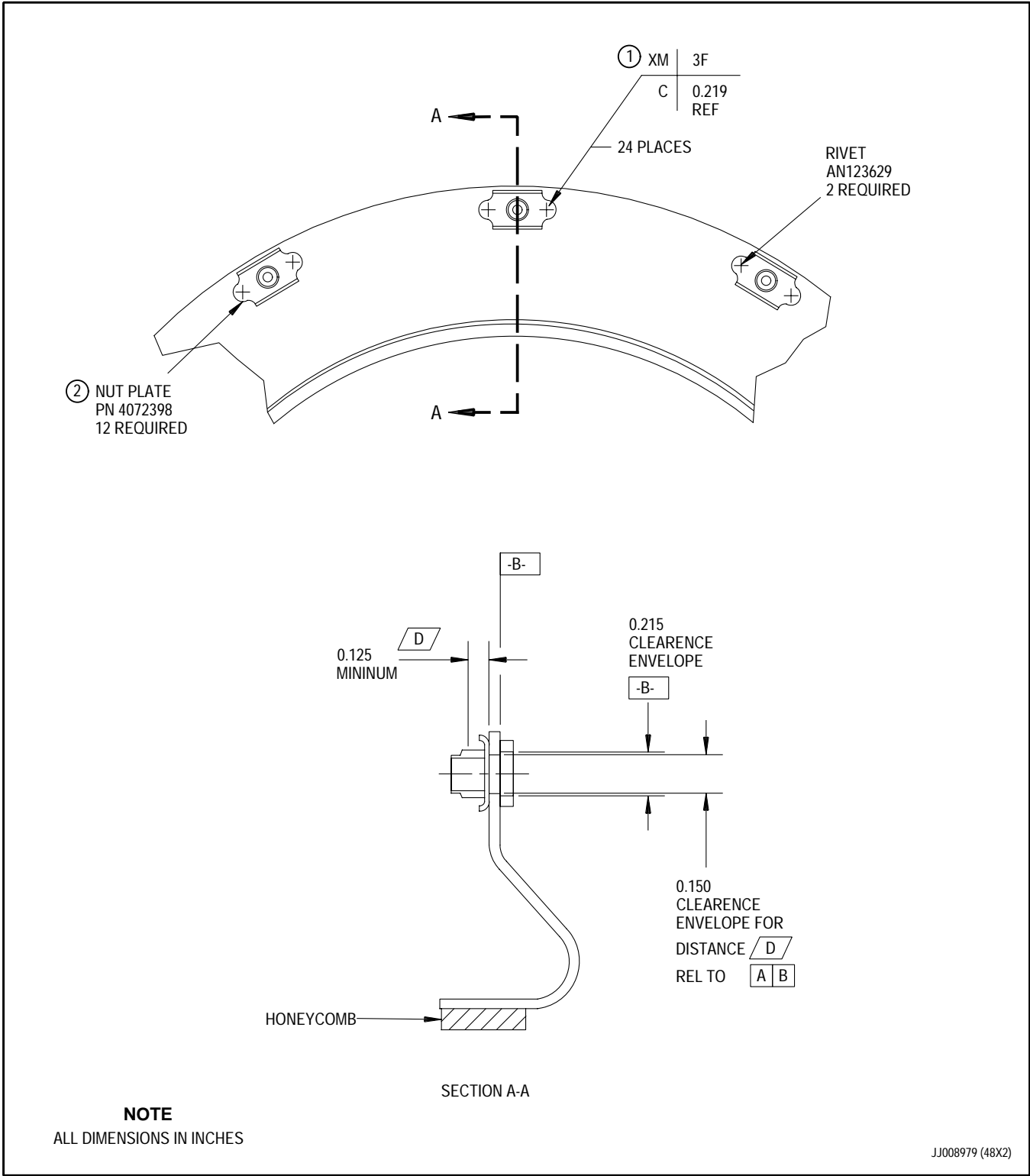


Figure 1. Fourth Stage Turbine Air Sealing Ring Assembly with Honeycomb - Nut Plate Replacement

**4. FOURTH STAGE TURBINE BRUSH SEAL
AND SUPPORT ASSEMBLY - BRUSH
REPLACEMENT.**

- a. Disassemble brush seal and support assembly using PWA 57934 fixture as follows:

- (1) Remove retaining ring from brush seal and support assembly.
- (2) Place PWA 57934 fixture detail -7 on work bench.
- (3) Place ring detail -9 and base detail -8 on work bench with hex bolt heads up.
- (4) Loosen all hex head bolts and separate details -8 and -9.
- (5) Place brush seal and support assembly with, brush seal down, on detail -8.

NOTE

Support mating diameters have 0.006 to 0.014 inch tight fit which will make them difficult to separate.

- (6) Install ring detail -9 with hex bolt heads up on top of brush seal and support.
- (7) Align bolts of detail -9 with threaded holes of detail -8 and tighten.
- (8) Place details -8 and -9 with brush seal support assembly on detail -7 with detail -8 down.
- (9) Tap top ring detail -9 between bolts until brush seal is separated from support.
- (10) Remove tooling.

- b. Assemble brush seal and support assembly using PWA 57934 fixture as follows:

- (1) Place brush seal with chamfer side of ID up, onto base detail -8.

NOTE

If dry ice is used for support ring, then go to step (5). If freezer is used go to step (3).

- (2) Freeze support ring in dry ice for 10 to 15 minutes, or place in freezer for 30 to 45 minutes.
- (3) Heat base detail -8 and brush seal in oven at 350° to 400°F (80° to 95°C) for 30 to 45 minutes.
- (4) Place heated base detail -8 and brush seal on heat resistant work bench.
- (5) Install brush seal onto chilled seal support and clamp parts together using six clamp blocks detail -24. Let stand until assembly normalizes to ambient temperature.
- (6) Remove tooling.
- (7) Install retaining ring.

WORK PACKAGE

TECHNICAL PROCEDURES

SUPPORT - TURBINE AIR SEALING RING, FOURTH STAGE

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4					0

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 4th stage turbine air sealing ring support.

2. FOURTH STAGE TURBINE AIR SEALING RING SUPPORT - BLEND REPAIR.

(See Figure 1.)



No blending permitted in boltholes or lugs.

a. Blending requirements are as follows:

- (1) All local blending shall extend to a distance of at least 15 times depth of damage from the center of the blend.
- (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- (3) Hand blend using fine stones.

b. Blend unserviceable nicks, dents and pits as follows (See figure 1.):

- (1) Blend up to 0.010 inch maximum depth at up to 12 locations and up to 0.015 inch maximum depth at 1 location maximum.
- (2) Remove raised metal.

c. Blend unserviceable scratches as follows:

- (1) Blend up to 0.005 inch maximum depth.
- (2) Remove sharp edges.

d. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9. No cracks allowed.

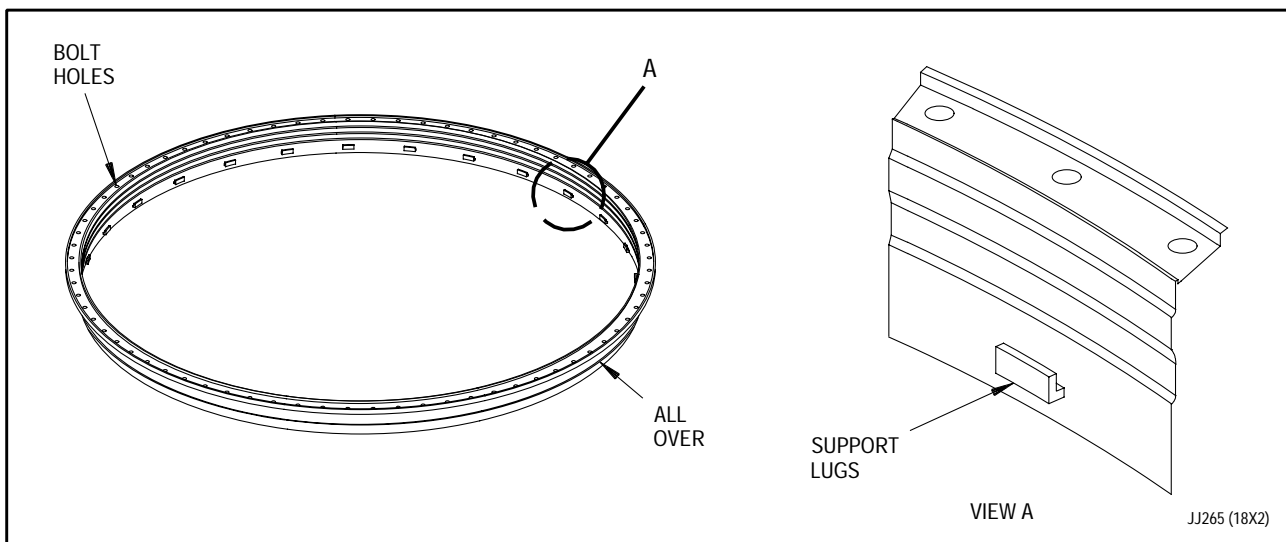


Figure 1. Fourth Stage Turbine Air Sealing Ring Support - Blend Repair

WORK PACKAGE

TECHNICAL PROCEDURES

RING SEGMENT, ASSEMBLY, AIR SEALING, TURBINE, FOURTH STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 7	0				
8 Blank	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
General Procedures - Marking, Electrochemical (SPOP 401)	SWP 023 02
Cleaning, Alkaline Rust Remover, Quick Coat (SPOP 18) - -	SWP 031 08
Cleaning, Grit Blast, Dry (SPOP 218) - - - - -	SWP 031 13
Plating, Nickel, on Stainless Steel, Nickel, or Cobalt	SWP 092 10
(SPOP 26) - - - - -	
Heat Treatment: Solution, Stabilization, or Precipitation	SWP 095 01
Cycles (SPOP 761 or 762) - - - - -	

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature

Specification/Vendor Part Number

Cloth, emery

Silicon carbide No. 220 grit

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION

- a. This work package contains instructions for the repair of the 4th stage turbine air sealing ring segment assembly.

**2. FOURTH STAGE TURBINE AIR SEALING
RING SEGMENT ASSEMBLY - HONEYCOMB
REPLACEMENT.**

(See Figure 1.)

- a. Clean segment. Refer to
T.O. 2J-F100-53-1 SWP 031 08
(SPOP 18). Do not dip in oil.
- b. Remove honeycomb parts E
(4069982-03) and F (4069982-04)
(see figure 1) by machining or
stripping nickel braze. Refer
to T.O. 2-1-111 (SPOP 316).
Maintain ring segment minimum
thickness, Dimension L. No
residual braze on honeycomb
material permitted.
- c. Solution heat treat per
T.O. 2J-F100-53-1, SWP 095 01
(SPOP 761 or 762), except use
1900° to 1950°F (1038° to 1066°C).
- d. Reform segments as required to
obtain Dimension J in free
state.
- e. Fluorescent penetrant inspect
(high sensitivity). Refer to
T.O. 2J-F100-9 and evaluate per
T.O. 2-1-111 (SFPS 38). No
cracks allowed.
- f. Abrasive finish Area AC using
No. 220 grit or finer silicon
carbide emery cloth or optional
grit blast. Refer to
T.O. 2J-F100-53-1, SWP 031 13
(SPOP 218). Do not dip in
corrosion preventive oil.

- g. Nickel plate enclosed Area AC
0.0001 to 0.0006 inch thick per
T.O. 2J-F100-53-1, SWP 092 10
(SPOP 26).

NOTE

Ring material is AMS 5706
nickel alloy. Honeycomb
material is AMS 5536 nickel
alloy.

- h. Braze new honeycomb parts E
(4069982-03) and F (4069982-04)
in place per
AMS 2675 and as follows:
 - (1) Use AMS 4777 braze alloy.
 - (2) Braze at 1900° to 2000°F
(1038° to 1094°C) for 2 to 15
minutes.
 - (3) Braze in vacuum of
0.5 microns maximum or in
argon or hydrogen atmosphere
per AMS 2675.
 - (4) Cool at rate of 40°F (22°C)
per minute or faster from
braze temperature to 1000°F
(538°C).

NOTE

Fixturing during heat treat cycle is permissible to maintain Dimensions H & AA. Constraint contact allowed only on Surfaces M, V, H and W. No reforming permitted after heat treat.

- i. Stabilization and precipitation heat treat per T.O. 2J-F100-53-1, SWP 095 01 in argon or vacuum. Rockwell C hardness of 34-44 required for AMS 5706 ring segment. Hardness requirements waived for honeycomb parts E and F. No hardness impressions permitted on honeycomb.
- j. Inspect braze for coverage and leak test. Refer to T.O. 2-1-111 (SVIS 37).

NOTE

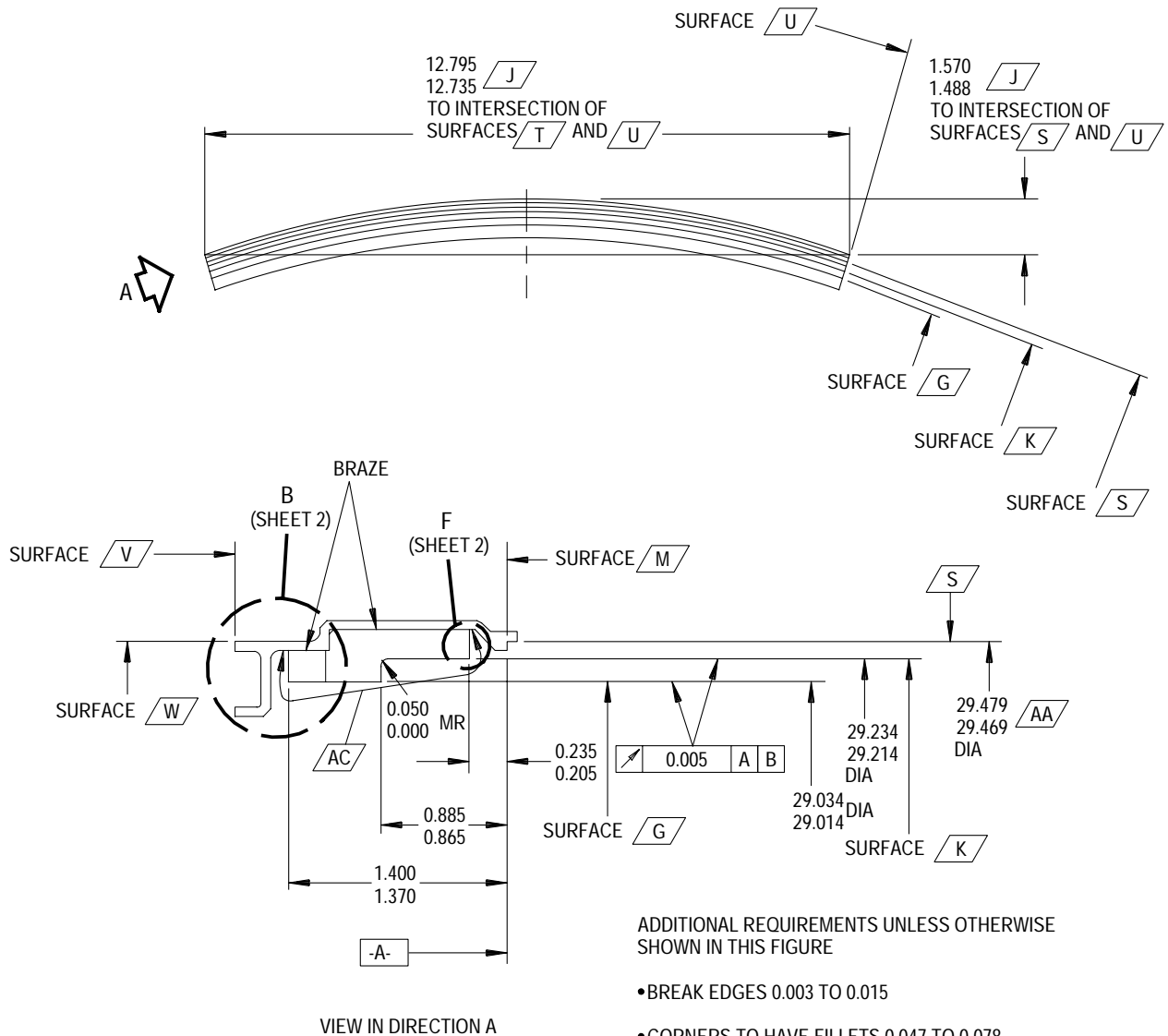
Final machined honeycomb dimensions must be met when Surface T is within Dimension H and Surface S is within Dimension AA.

- (1) Finish honeycomb parts E & F to dimensions shown in View A (sheet 2). Electrochemical metal removal (ECMR) or electrodischarge metal removal (EDMR) permitted per T.O. 2-1-111, PWA 97-3. Maximum permitted layover for finished honeycomb is 0.010 inch as depicted in View G (sheet 2).

NOTE

Parts must be within Dimensions J (sheet 1) in the free state or the entire repair must be repeated. Reforming of completed part is not permitted.

- (2) Inspect Dimensions H and AA per requirements of sheet 1. Constraint contact allowed only on Surfaces M, V, H and W. If inspection requirements have not been maintained, the entire repair must be repeated. No reforming is permitted subsequent to braze or stabilization and precipitation heat treat cycles.
- (3) Permanently identify repaired segments by deep etching beehive symbol per T.O. 2J-F100-53-1, SWP 023 02 (SPOP 401) in area near part number.



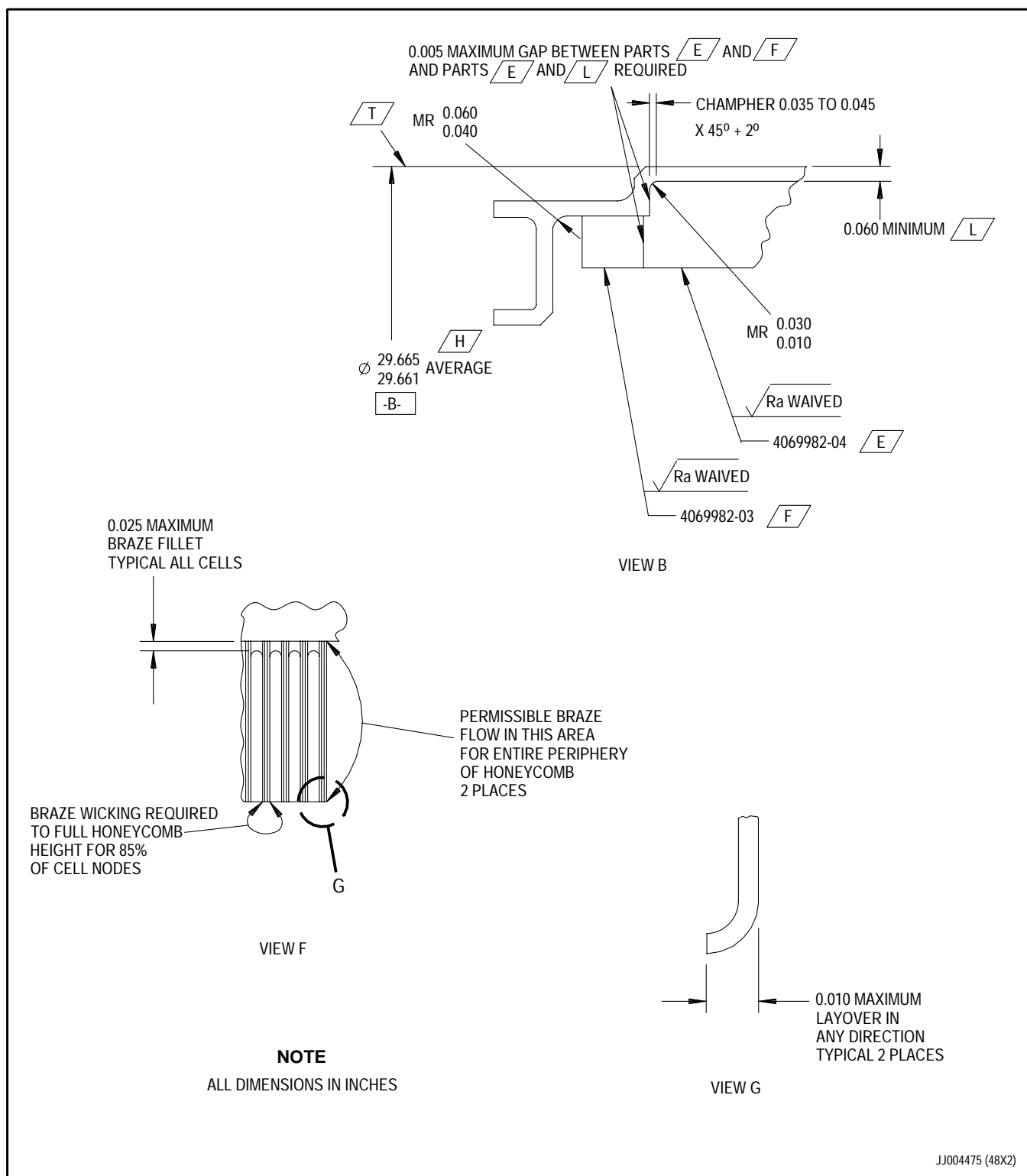
ADDITIONAL REQUIREMENTS UNLESS OTHERWISE SHOWN IN THIS FIGURE

- BREAK EDGES 0.003 TO 0.015
- CORNERS TO HAVE FILLETS 0.047 TO 0.078 MODIFIED RADIUS UOS
- ALL DIMENSIONS APPLY WHEN SURFACE \boxed{T} IS WITHIN DIMENSION \boxed{H} AND SURFACE \boxed{S} IS WITHIN DIMENSION \boxed{AA} IN FREE STATE OR CONSTRAINED
- IN FREE STATE, SURFACE \boxed{M} IS $\boxed{0.015}$ AND RING SEGMENT MUST CONFORM TO DIMENSION \boxed{J}
- CONSTRAINT CONTACT ALLOWED ONLY ON \boxed{M} , \boxed{V} , \boxed{O} , \boxed{H} , AND \boxed{W}

NOTE
ALL DIMENSIONS IN INCHES

JJ004474 (48X2)

Figure 1. Fourth Stage Turbine Air Sealing Ring Segment Assembly - Honeycomb Replacement (Sheet 1 of 2)



**Figure 1. Fourth Stage Turbine Air Sealing Ring Segment Assembly -
Honeycomb Replacement (Sheet 2 of 2)**

WORK PACKAGE

TECHNICAL PROCEDURES

DISK - TURBINE, FOURTH STAGE -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4	30	5	0	6 Blank	0

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Cloth, abrasive crocus	P-C-458

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the 4th stage turbine disk.

2. FOURTH STAGE TURBINE DISK - BLEND REPAIR.

(See Figure 1.)



Under no circumstances shall snap diameters of disk be changed. Evaluation of disk growth would be impaired. Do not blend into blade slots.

- a. Blending requirements are as follows:

- (1) All local blending shall extend to a distance of at least 15 times the depth of the damage with damaged area being the center of the blend, except for pin location slot as defined as per step d.
- (2) Surface finish of all blends shall be as smooth or smoother than original finish.

- b. Blend repair unserviceable nicks, dents, and scratches as follows:

- (1) Use fine stone.
- (2) Remove raised metal.
- (3) Blend damage up to 0.005 inch deep maximum. Scratches in disk are reparable up to a maximum of 1.000 inch in length.
- (4) Do not blend into blade slots.

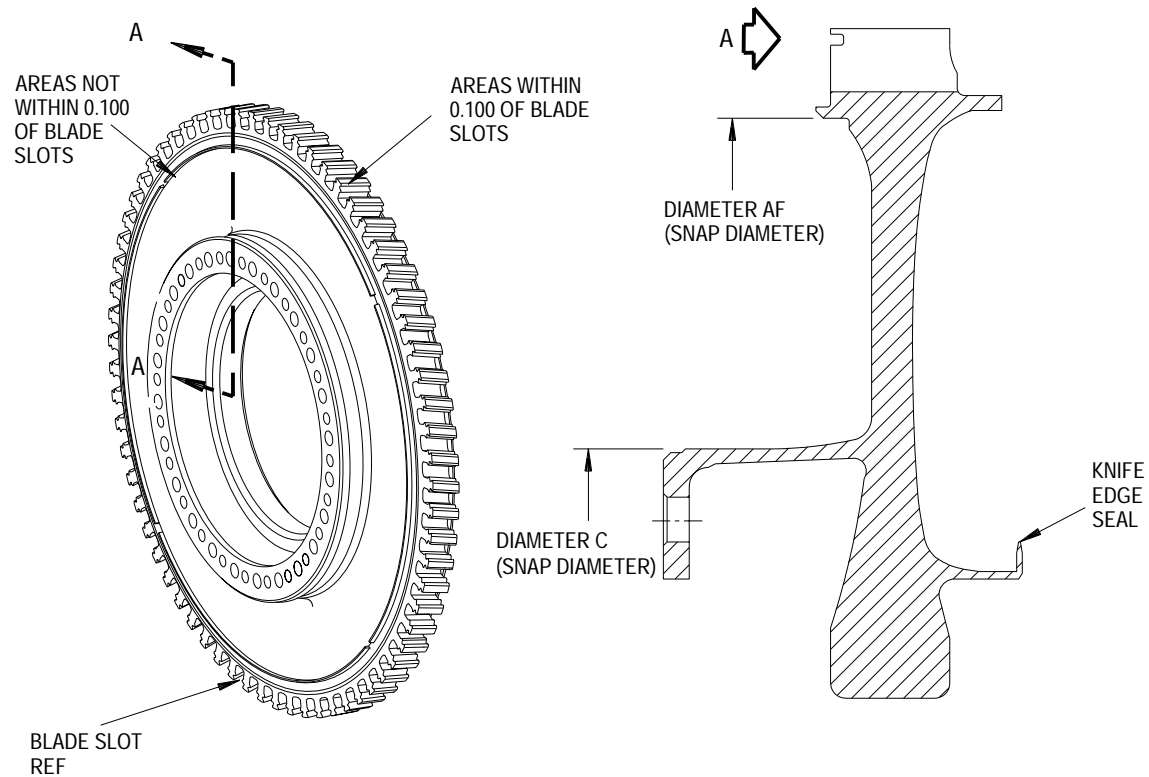
- c. Blend repair unserviceable corrosion not within 0.100 inch of blade slots, as follows:

- (1) Blend damage up to 0.002 inch deep to a maximum of two square inches of surface.
- (2) Hand polish using blending stones and crocus cloth.

- d. Blend edges of pin location slot (1 place) to remove damage as defined in Figure 1. limits, maintain dimensional requirements as shown.

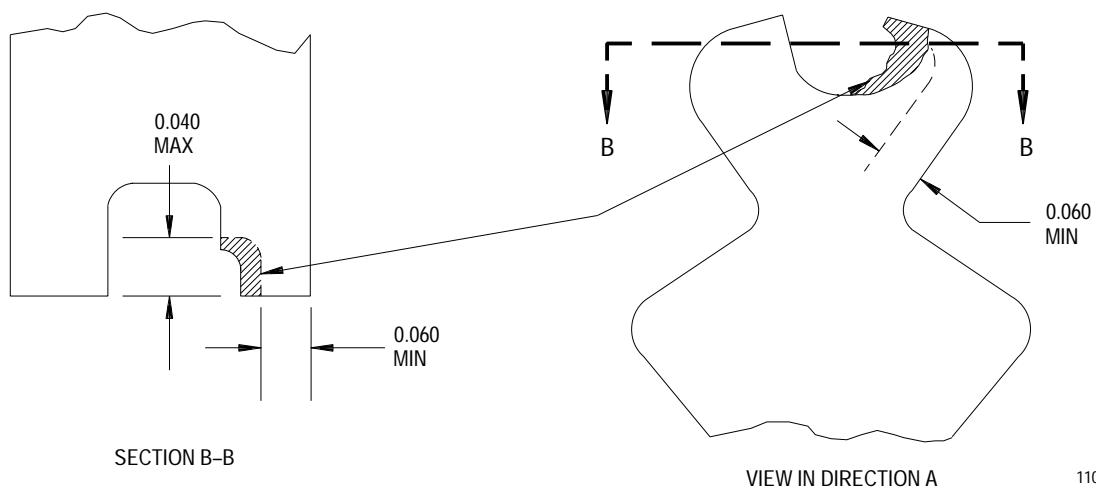
- (1) Remove raised metal.
- (2) Do not blend into adjacent blade slot(s).
- (3) Surface finish to be smooth or smoother than original finish.

- e. Fluorescent penetrant inspect to SFPS-M per SPOP 84. Refer to T.O. 2-1-111. No cracks or crack like indications allowed after blending.



NOTE

ALL DIMENSIONS IN INCHES
UNLESS OTHERWISE SPECIFIED



110835 (48X2)

Figure 1. Fourth stage Turbine Disk - Repair

**3. FOURTH STAGE TURBINE DISK -
KNIFE-EDGE SEAL.**

(See figure 1.)

- a. Blending requirements are as follows:

(1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.

(2) Surface finish of all blends shall be as smooth or smoother than original finish.

- b. Blend repair unserviceable nicks, dents, and small cracks in knife-edge seal as follows:

(1) Use fine stone.

(2) Remove raised metal as required.

(3) Blend (single blends) up to a maximum length of 1.000 inch.

(4) Maximum cumulative circumferential length per knife-edge (more than one blend) is 2.000 inches.

(5) Maximum depth of blends shall be 0.045 inch.

(6) Minimum of 1/8 inch radius at both ends of each blend repair.

- c. Fluorescent penetrant inspect. Refer to T.O. 2J-F100-9 after blending. No cracks allowed.

WORK PACKAGE

TECHNICAL PROCEDURES

CASE - ASSEMBLY OF, TURBINE EXHAUST -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	2 - 7	0	8	28

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Cleaning, Vapor Degreasing (SPOP 3) - - - - -	WP 031 01
Cleaning, Alkaline Rust Remover, Long Soak (SPOP 203) - -	WP 031 09
Welding, Inert Gas Fusion - - - - -	WP 093 01

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Weld Wire, filler	AMS 5837

EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Rivet	AN 123619	As required

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the turbine exhaust case assembly.

2. TURBINE EXHAUST CASE ASSEMBLY OIL TUBE STRUT - HEAT SHIELD WELD CLEARANCE.

- a. Repair to eliminate interference as follows:
 - (1) Grind weld overflow down to, but not into, parent material.

- (2) Recheck clearance.

- (3) If clearance is acceptable proceed as follows:

- (a) Visually inspect ground area.

- (b) Perform fluorescent penetrant inspection on ground area. Refer to T.O. 2J-F100-9. No cracks allowed.

**3. TURBINE EXHAUST CASE ASSEMBLY
STRUT SUPPORT ROD WELD CLEARANCE.**

- a. Repair to eliminate interference as follows:
 - (1) Grind any amount of weld material above parent material.
 - (2) Recheck clearance.
 - (3) If clearance is acceptable, proceed as follows:
 - (a) Visually inspect ground area.
 - (b) Perform fluorescent penetrant inspection on ground area. Refer to T.O. 2J-F100-9. No cracks allowed.

**4. TURBINE EXHAUST CASE ASSEMBLY -
NUT PLATE REPLACEMENT.**

(See Figure 1.)

- a. Grind off upset head of rivet at two locations per nut plate.
- b. Remove and discard unserviceable nut plate or reuse if undamaged.
- c. Re-install serviceable nut plates or install new nut plates using rivets. Refer to T.O. 2-1-111.

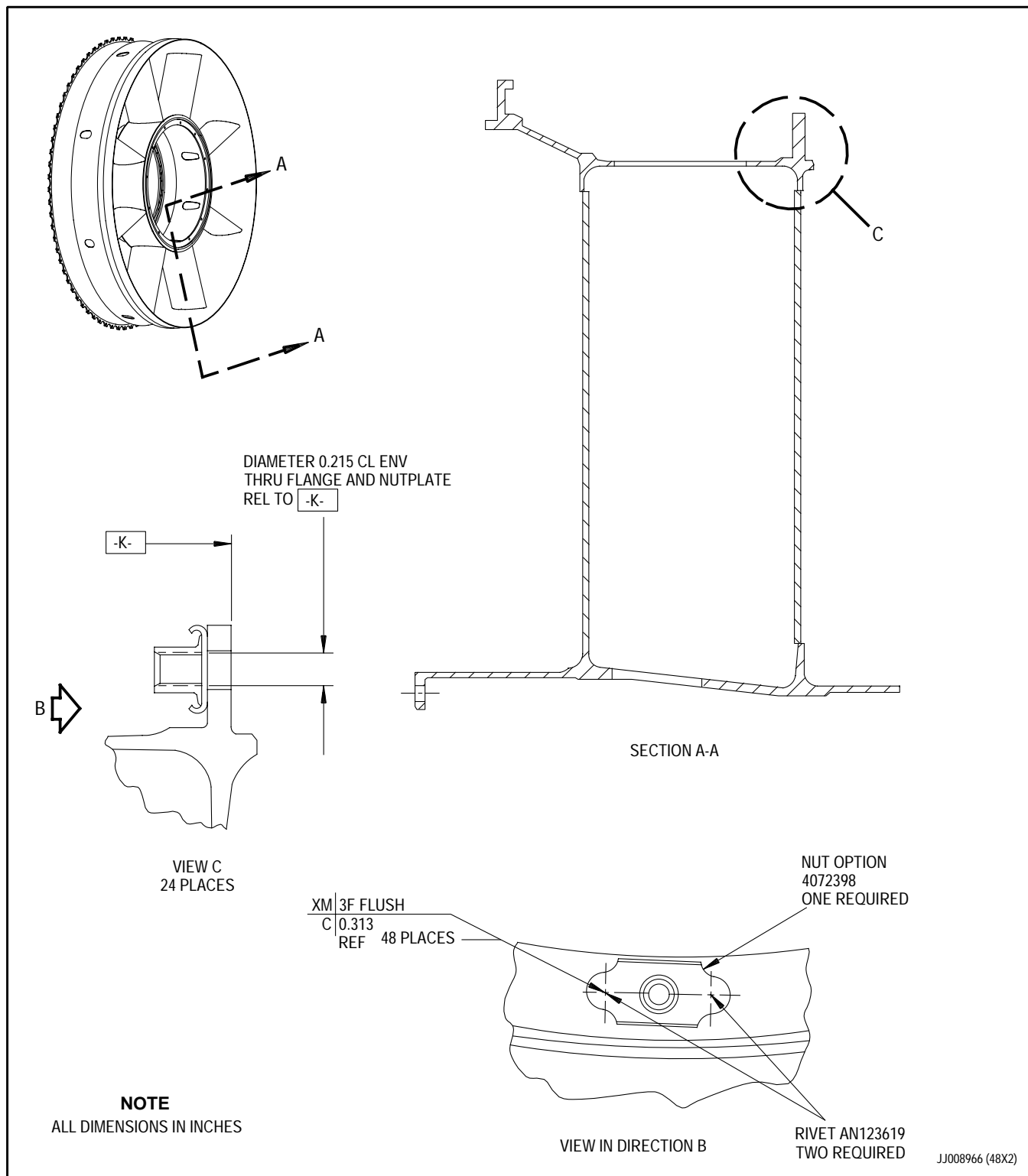


Figure 1. Turbine Exhaust Case Assembly - Nut Plate Replacement

**5. TURBINE EXHAUST CASE ASSEMBLY
STRUT DENT REPAIR.**

(See Figure 2.)

a. Repair dents in turbine exhaust case assembly struts as follows:

- (1) Reshape, to within 0.200 inch of original contour, any number of dents.
- (2) No sharp corners permitted.
- (3) Unlimited area for reshaping of dent areas.
- (4) Fluorescent penetrant inspect. Refer to T.O. 2J-F100-9. No cracks allowed.
- (5) Vapor degrease. Refer to T.O. 2J-F100-53-1, SWP 031 01 (SPOP 3).

b. Weld repair dents in turbine exhaust case struts as follows:

NOTE

Parent material of strut is AMS 5599 nickel alloy.

- (1) Clean weld areas. Refer to T.O. 2J-F100-53-1, SWP 031 09 (SPOP 203). Surface texture shall be per PWA 362 in T.O. 2-1-111.

- (2) Dents 0.250 inch diameter maximum and 0.030 inch deep maximum and resulting in hole in strut may be welded and finished to original strut contour. Use manual gas tungsten arc (GTAW-MA) method and AMS 5837 filler metal. Refer to T.O. 2J-F100-53-1, SWP 093 01.
- (3) Dents in any one square inch area and 0.030 inch deep maximum may be built up with filler metal and finished to original contour of strut. Use TIG method and AMS 5837 filler metal. No weld allowed in Area C. (See figure 2.)
- (4) Fluorescent penetrant inspect welds. Refer to T.O. 2J-F100-9. No cracks allowed.
- (5) Vapor degrease. Refer to T.O. 2J-F100-53-1, SWP 031 01 (SPOP 3).

6. TURBINE EXHAUST CASE ASSEMBLY STRUT - CRACK WELD REPAIR.

(See figure 2.)

- a. Weld repair cracks in turbine exhaust case strut as follows:

(1) Clean weld areas. Refer to T.O. 2J-F100-53-1, SWP 031 09 (SPOP 203). Surface texture shall be per PWA 362. Refer to T.O. 2-1-111.

(2) Fluorescent penetrant inspect areas to be welded to determine ends of cracks. Refer to T.O. 2J-F100-9.

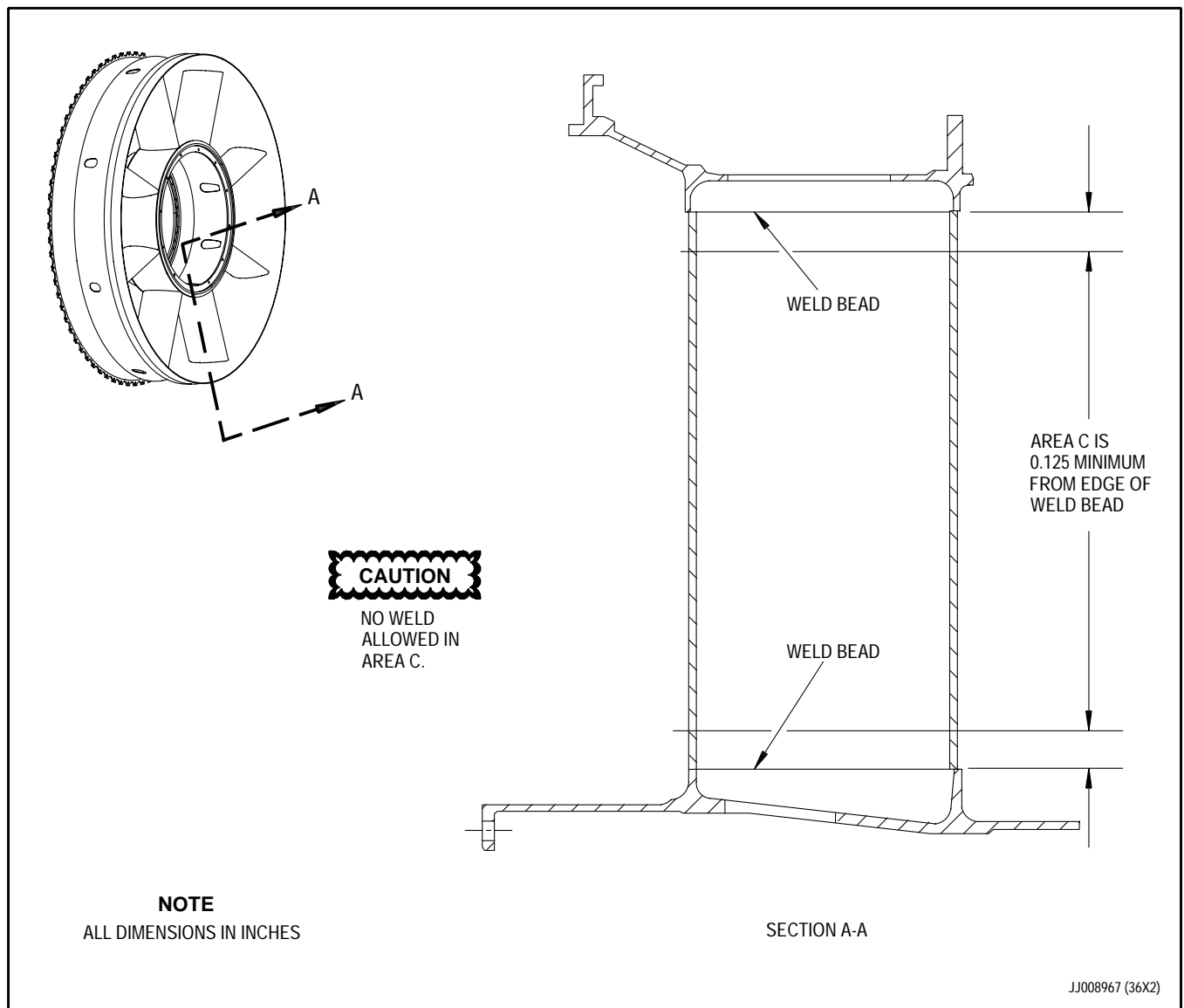


Figure 2. Turbine Exhaust Case Assembly - Weld Repair Strut

- (3) Rout out cracks completely. Hold material removal to a minimum.
- (4) Vapor degrease. Refer to T.O. 2-1-111, (SPOP 3), except omit application of corrosion preventive compound.
- (5) Weld cracks using tungsten inert gas (GTAW-MA) method and AMS 5837 filler metal. Refer to T.O. 2J-F100-53-1, SWP 093 01. No weld allowed in Area C. (See figure 2.)
- (6) Fluorescent penetrant inspect repaired areas. Refer to T.O. 2J-F100-9. No cracks allowed.
- (7) Vapor degrease. Refer to T.O. 2-1-111, (SPOP 3).

**7. TURBINE EXHAUST CASE ASSEMBLY OD
CASE TRAILING EDGE - BLEND REPAIR.**

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to distance of at least 15 times depth of damage from center of blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable nicks and chaffing in turbine exhaust case assembly as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal.
 - (3) Blend repair damage up to 0.50 inch deep from rear edge.
- c. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9.

WORK PACKAGE

TECHNICAL PROCEDURES

SEAL - ASSEMBLY OF, NO. 5 BEARING -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 10

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	14	7 - 9	14	10 Blank	0
2 - 6	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Cloth, abrasive, crocus	P-C-458

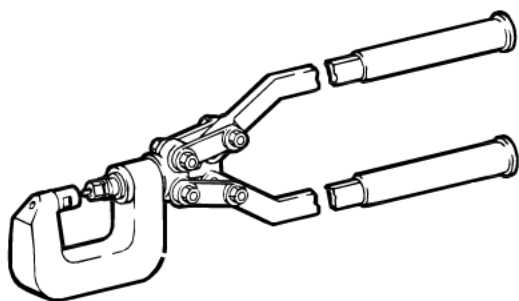
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

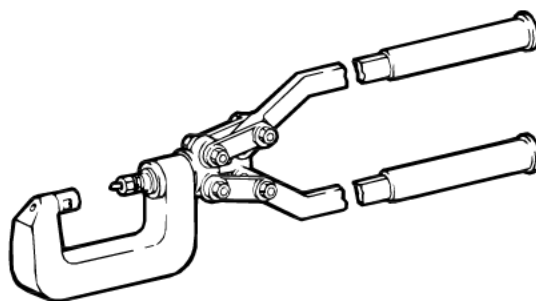
Paragraph	Function - Tool Nomenclature	Tool Number
3	No. 5 Bearing Seal Assembly - No. 5 Bearing Seal Pin Replacement	
	Drift - - - - -	PWA 52741
	Riveter - - - - -	PWA 50889
4	No. 5 Bearing Seal Assy Helical Compression Spring Seat Replacement	
	Riveter - - - - -	PWA 50888

ILLUSTRATED SUPPORT EQUIPMENT



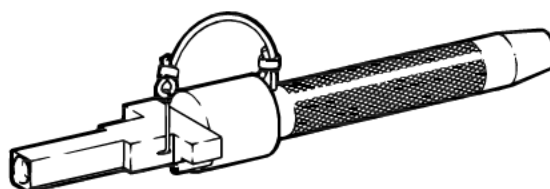
PWA 50888 -C

Figure T1. PWA 50888 Riveter



PWA 50889 -C

Figure T2. PWA 50889 Riveter



PWA 52741 -C

Figure T3. PWA 52741 Drift

1. INTRODUCTION.

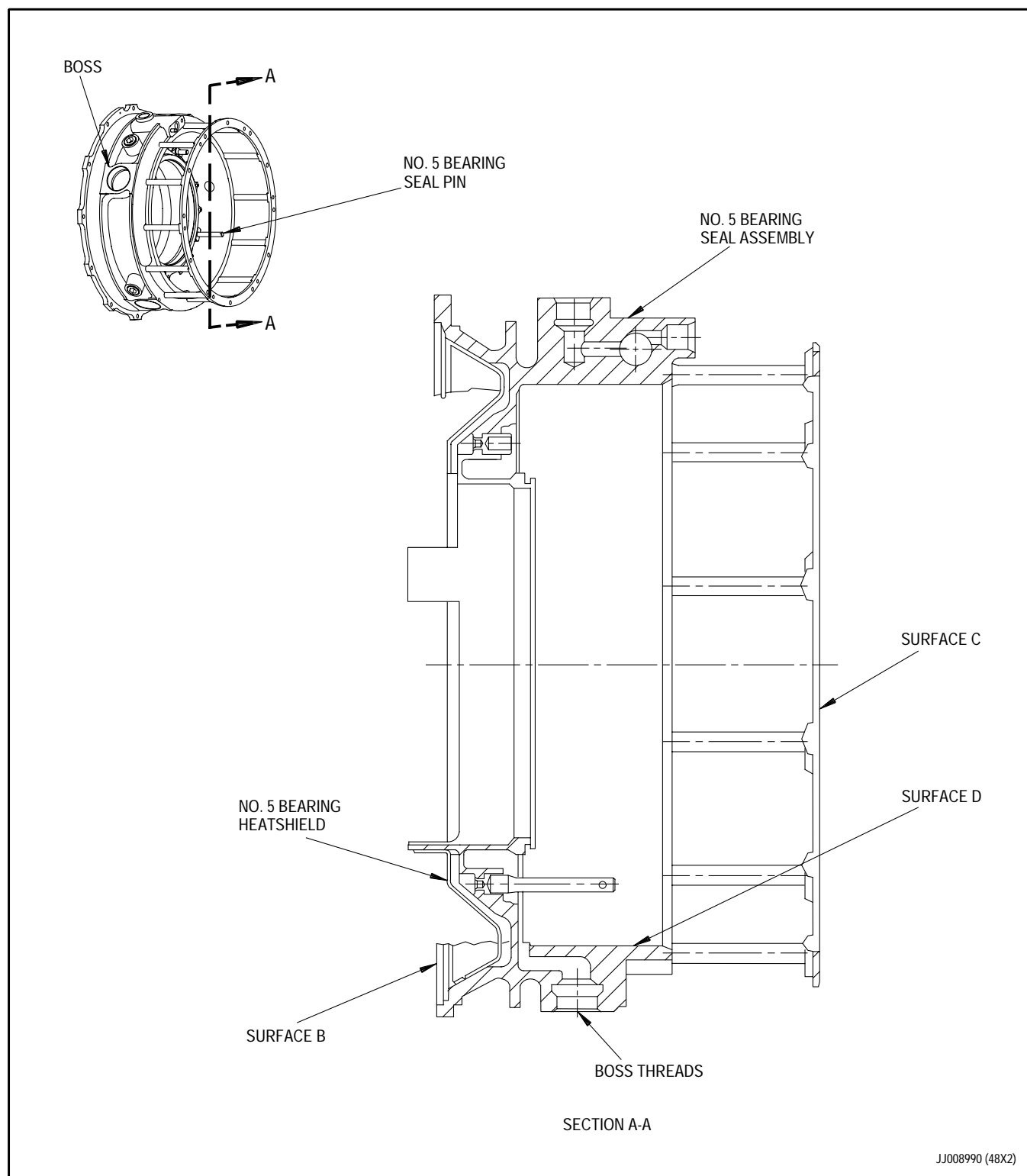
- a. This work package contains instructions for repair of the No. 5 bearing seal assembly.

2. NO. 5 BEARING SEAL ASSEMBLY - BLEND REPAIR.

(See Figure 1.)

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable nicks, dents, and scratches in No. 5 bearing seal assembly as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal.
 - (3) Blend damage up to 0.010 inch deep and 0.010 inch wide.

- c. Blend repair unserviceable thread damage in bosses as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal and pickup.
- d. Blend repair unserviceable nicks, scratches, and wear in seal pin as follows:
 - (1) Polish with fine crocus cloth P-C-458.
 - (2) Hand polish in direction lengthwise with respect to pin.
 - (3) Pin diameter shall not be reduced more than 0.002 inch.
- e. Blend repair galling in surfaces B and C as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal.
 - (3) Blend damage up to 0.003 inch deep.



JJ008990 (48X2)

Figure 1. No. 5 Bearing Seal Assembly - Blend Repair

- f. Blend repair unserviceable nicks, dents, and scratches galling on surface D as follows:

- (1) Use fine stone.
- (2) Remove raised metal.
- (3) Blend damage up to 0.003 inch deep and 0.010 inch wide. 6 places maximum.

- g. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9.

3. NO. 5 BEARING SEAL ASSEMBLY - NO. 5 BEARING SEAL PIN REPLACEMENT.

(See Figure 2.)

- a. Remove heatshield per paragraph 5.



To prevent damage, do not hammer pins to remove.

- b. Remove unserviceable pin by drilling flared end. Press out pins.

- c. Install replacement pin as follows:

NOTE

Wire detail of drift will pick up hole in pin.

- (1) Insert replacement pin into PWA 52741 pin drift.

NOTE

When pin is seated in support, pinhole in end of pin shall be properly oriented.

- (2) Align hole in pin to receiver slot opening in support with drift piloting on ID of support.

- (3) Seat pin.

NOTE

To prevent damage, do not hammer pin to flare.

- d. Use PWA 50889 riveter to flare.
- e. Reinstall heatshield per paragraph 5.

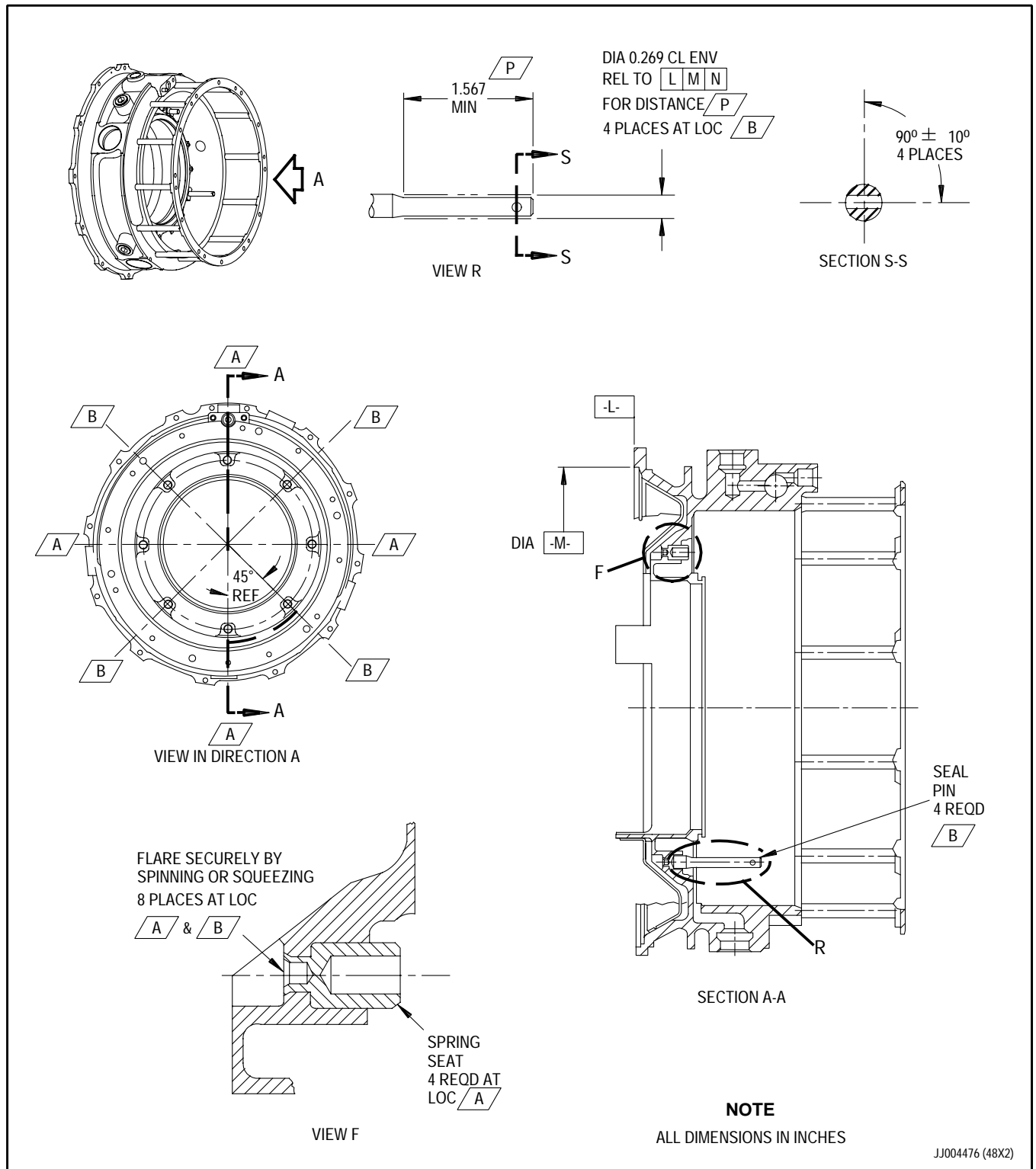


Figure 2. No. 5 Bearing Seal Assembly - Seal Pin and Helical Compression Spring Seat Replacement

**4. NO. 5 BEARING SEAL ASSEMBLY -
HELICAL COMPRESSION SPRING SEAT
REPLACEMENT.**

(See figure 2.)

- a. Remove heatshield per paragraph 5.



To prevent damage, do not hammer seats to remove.

- b. Remove unserviceable seats by drilling flared end using carbide or cobalt drill. Press seats out.
- c. Install seats as shown.



To prevent damage, do not hammer seats to flare.

- d. Flare seats using PWA 50888 riveter.
- e. Install heatshield per paragraph 5.

**5. NO. 5 BEARING SEAL ASSEMBLY -
HEATSHIELD REPLACEMENT.**

(See Figure 3.)

- a. Using a carbide or cobalt bit, drill or grind off upset end of rivets. Use care not to remove parent material if heatshield will be re-used.
- b. Remove heatshield and retain for reuse or repair, if applicable.
- c. Position new heatshield in seal as shown in figure 3, and secure in place.
- d. Use a No. 30 carbide or cobalt drill bit to transfer drill 0.128 to 0.132 inch rivet holes from support to heatshield 12 places as shown in figure 3, Section A-A.
- e. Use a No. 40 or 41 carbide or cobalt drill to transfer drill 0.096 to 0.100 inch rivet holes from support to heatshield six places as shown in Section E-E. Deburr rivet holes.
- f. Install new or serviceable heatshield using AN123336 and AN123618 rivets per figure 3. Refer to T.O. 2-1-111.

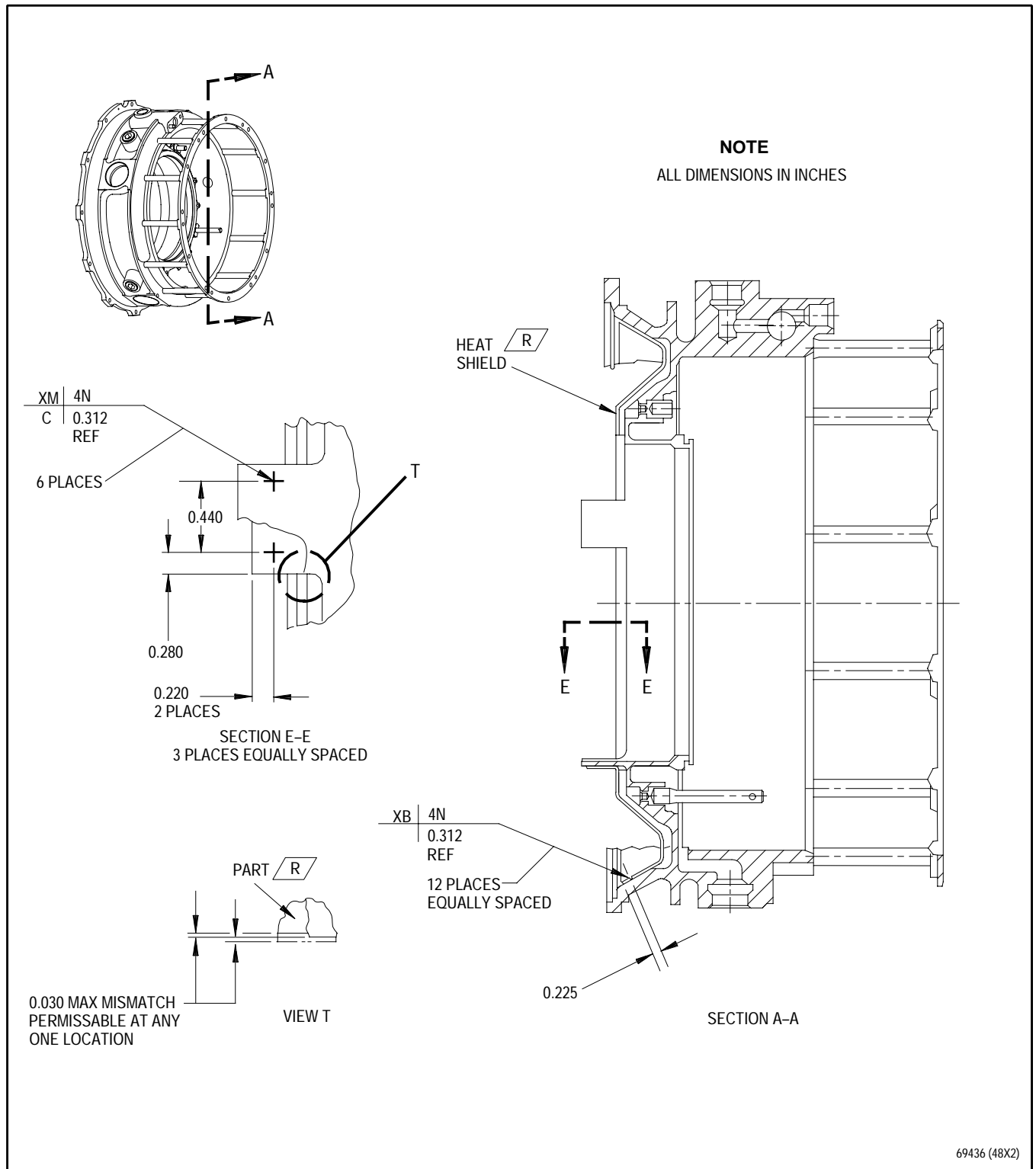


Figure 3. No. 5 Bearing Seal Assembly - Heatshield Replacement

WORK PACKAGE

TECHNICAL PROCEDURES

BEARING - ROLLER, CYLINDRICAL, NO. 5 —

REPAIR

EFFECTIVITY: F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4	Added	27		

REFERENCE MATERIAL REQUIRED

Title	Number
Depot Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Qualified Repair Source List (QRSL) Fan Drive Turbine Module - - - - -	WP 605 00
Depot Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module Parts - Cleaning - - - - -	WP 201 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of No. 5 bearing.

2. NO. 5 BEARING - REPAIR.

(See Table 1.)

NOTE

Vendor repair procedures listed in qualified repair source list (QRSL) shall be kept current by incorporating all T.O. changes that affect the repaired part. If vendor procedure requires revision to comply with T.O. changes, or if vendor wishes to revise procedure, then vendor must notify SA-ALC/LPFE of need for revision. SA-ALC/LPFE will authorize Pratt & Whitney to coordinate directly with vendor for review and update of procedure revision listed QRSL.

- a. This is proprietary repair. Refer to T.O. 2J-F100-53-1, WP 605 00 for QRSL. Logistics control number (LCN) is EECFAJ. Repair task codes are identified in table 1.
- b. Carefully package and label No. 5 bearing and bearing details per WP 201 00.

Table 1. No. 5 Bearing - Repair

LCN Code	Task Code	Location	Distress Mode
EECFAJ	JGDFGAA	Outer rings	Heat discoloration
EECFAJ	JGDFGAB	Outer rings	Galling
EECFAJ	JGDFGAC	Outer rings	Brinelling
EECFAJ	JGDFGAD	Outer rings	Cracks
EECFAJ	JGDFGAE	Outer rings	Pits
EECFAJ	JGDFGAF	Outer rings	Nicks and dents
EECFAJ	JGDFGAG	Outer rings	Scratches, scuffs, and scoring
EECFAJ	JGDFGAH	Outer rings	Skidding
EECFAJ	JGDFGAJ	Outer rings	Spalling
EECFAJ	JGDFGAK	Roller	Galling
EECFAJ	JGDFGAL	Roller	Heat discoloration
EECFAJ	JGDFGAM	Roller	Brinelling
EECFAJ	JGDFGAN	Roller	Pits
EECFAJ	JGDFGAP	Roller	Nicks and dents
EECFAJ	JGDFGAQ	Roller	Scratches, scuffs, and scoring
EECFAJ	JGDFGAR	Roller	Skidding
EECFAJ	JGDFGAS	Roller	Spalling
EECFAJ	JGDFGAT	Roller	End wear
EECFAJ	JGDFGAU	Cage	Plate flaking and peeling
EECFAJ	JGDFGAV	Cage	Plate wear
EECFAJ	JGDFGAW	Cage	Out of round
EECFAJ	JGDFGAX	Cage	Cracks
EECFAJ	JGDFGAY	Rings	Outer race scoring

WORK PACKAGE**TECHNICAL PROCEDURES****BALL-END - ROD, NO. 5 BEARING SUPPORT -****REPAIR****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3					
4 Blank					

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the No. 5 bearing support rod ball-end.

2. NO. 5 BEARING SUPPORT ROD BALL-END - LAP REPAIR.

- a. Lap sealing surface. (See figure 1.)

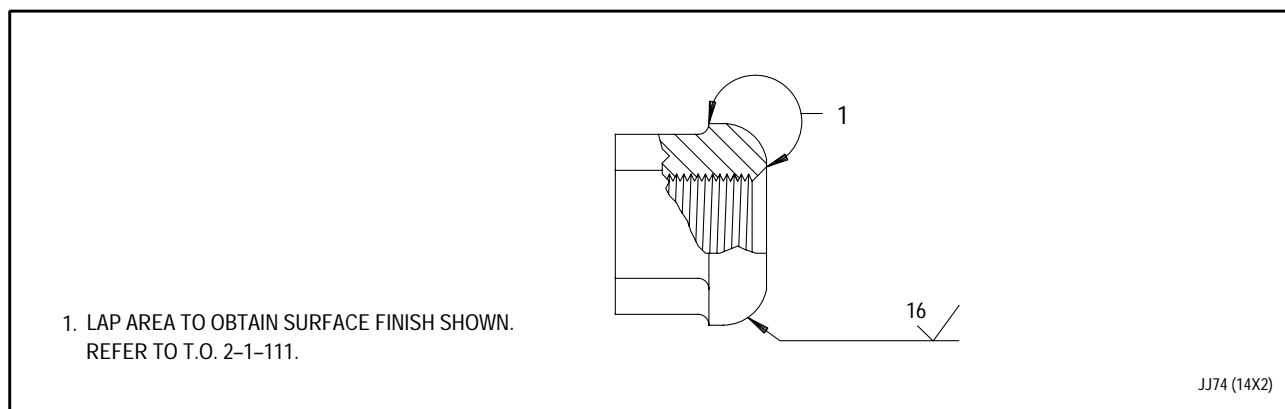


Figure 1. No. 5 Bearing Support Rod Ball-end - Lap Repair

WORK PACKAGE

TECHNICAL PROCEDURES

SEAL ASSEMBLY, FACE, NO. 5 BEARING -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

This Work Package Supersedes WP 430 00 Through and Including Change 0.

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4					
					19

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

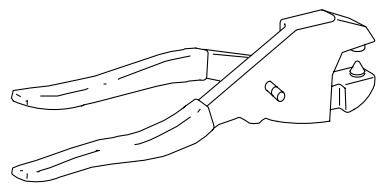
EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
RIVET	PN 4001006	8
SEAT, SPRING	PN 4014767	4

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
3	NO.5 BEARING FACE SEAL ASSEMBLY - RIVET AND HELICAL COMPRESSOR SPRING SEAT - REPLACEMENT	
	RIVETER - - - - -	PWA 50310

ILLUSTRATED SUPPORT EQUIPMENT



PWA 50310 -C

Figure T1. PWA 50310 RIVETER

1. INTRODUCTION.

- a. This work package contains instructions for repair of the No. 5 bearing face seal assembly.

2. NO. 5 BEARING FACE SEAL ASSEMBLY - CARBON SEAL ELEMENT LAP REPAIR.

(See Figure 1.)

- a. Lap carbon seal sealing face to obtain required surface finish and flatness. (See Figure 1.) Refer to T.O. 2-1-111.

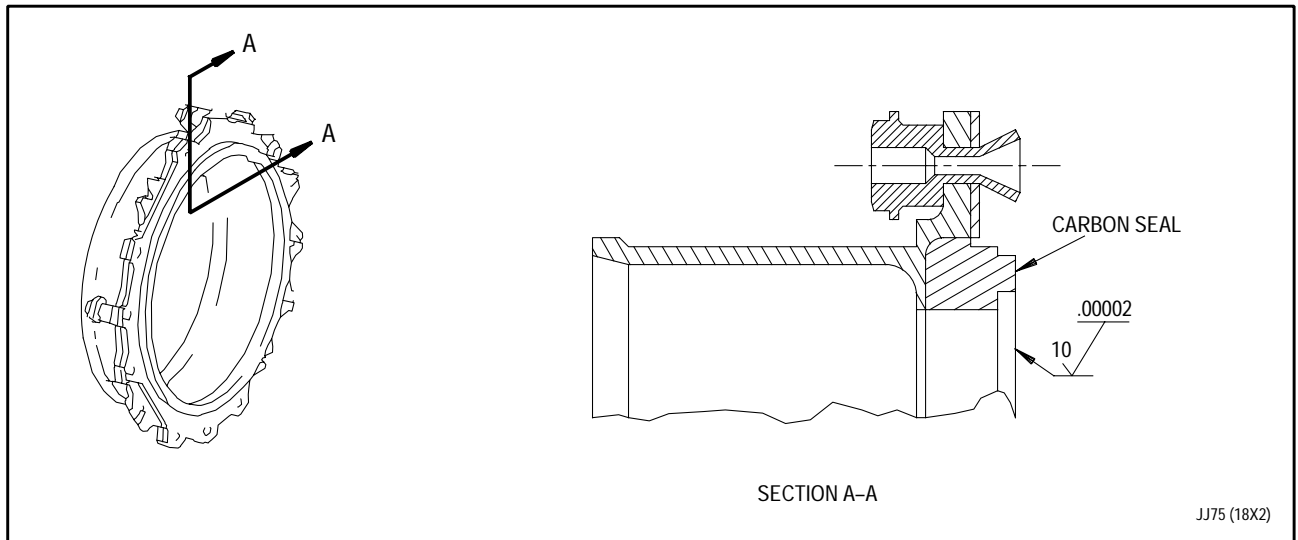


Figure 1. No. 5 Bearing Face Seal Assembly - Carbon Seal Element Lap Repair

3. NO.5 BEARING FACE SEAL ASSEMBLY - RIVET AND HELICAL COMPRESSOR SPRING SEAT - REPLACEMENT.

(See Figure 2.)

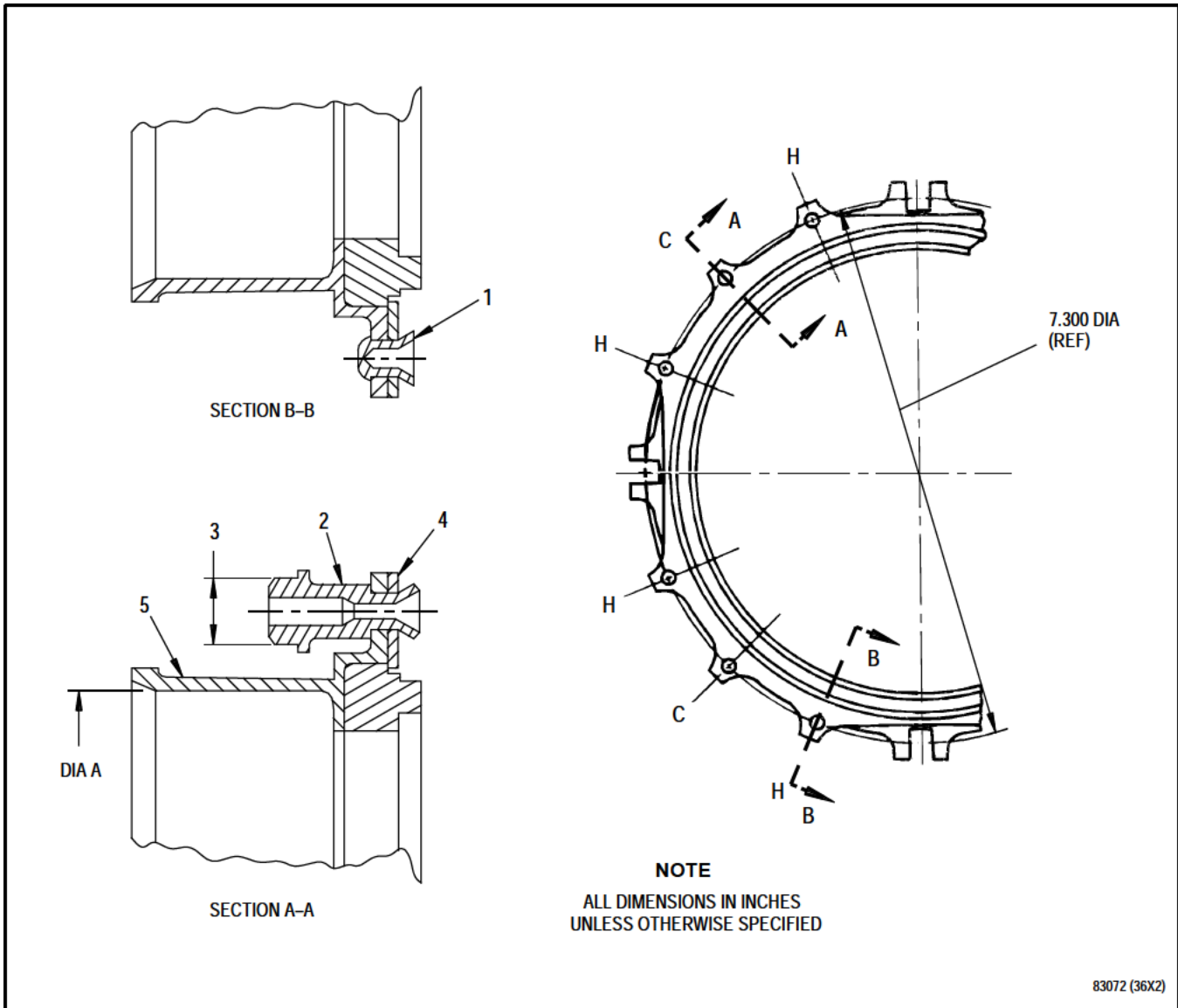
- c. Use PWA 50310 riveter to flare as shown. Flare by spinning or squeezing. Do not hammer.

NOTE

This repair is not required if carbon face seal element will be replaced.

- a. Use appropriate size carbide or cobalt drill to drill retaining flare of unserviceable spring seat(2) or rivet(1).
- b. Install new spring seat(2) or rivet(1) into mounting hole on flange as shown.

6430^435



1. Rivet. Eight required at Locations H.
2. Helical compression spring seat. Four required at Locations C.
3. This diameter for its entire length shall be located within 0.010 inch radius of true position in relation to Diameter A.
4. Plate - PN 4014758 (typical)
5. Housing - PN 4014755 (typical)

Figure 2. Rivet and Helical Compression Spring Seat - Replacement

WORK PACKAGE

TECHNICAL PROCEDURES

SUPPORT ASSEMBLY - NO. 5 BEARING, INNER -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 5	0				
6 Blank	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the No. 5 bearing inner support assembly.

**2. NO. 5 BEARING SUPPORT ASSEMBLY -
BLEND REPAIR.**

(See Figure 1.)

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable nicks, dents, and scratches in No. 5 bearing support assembly as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal.

- (3) Blend damage up to 0.005 inch deep.

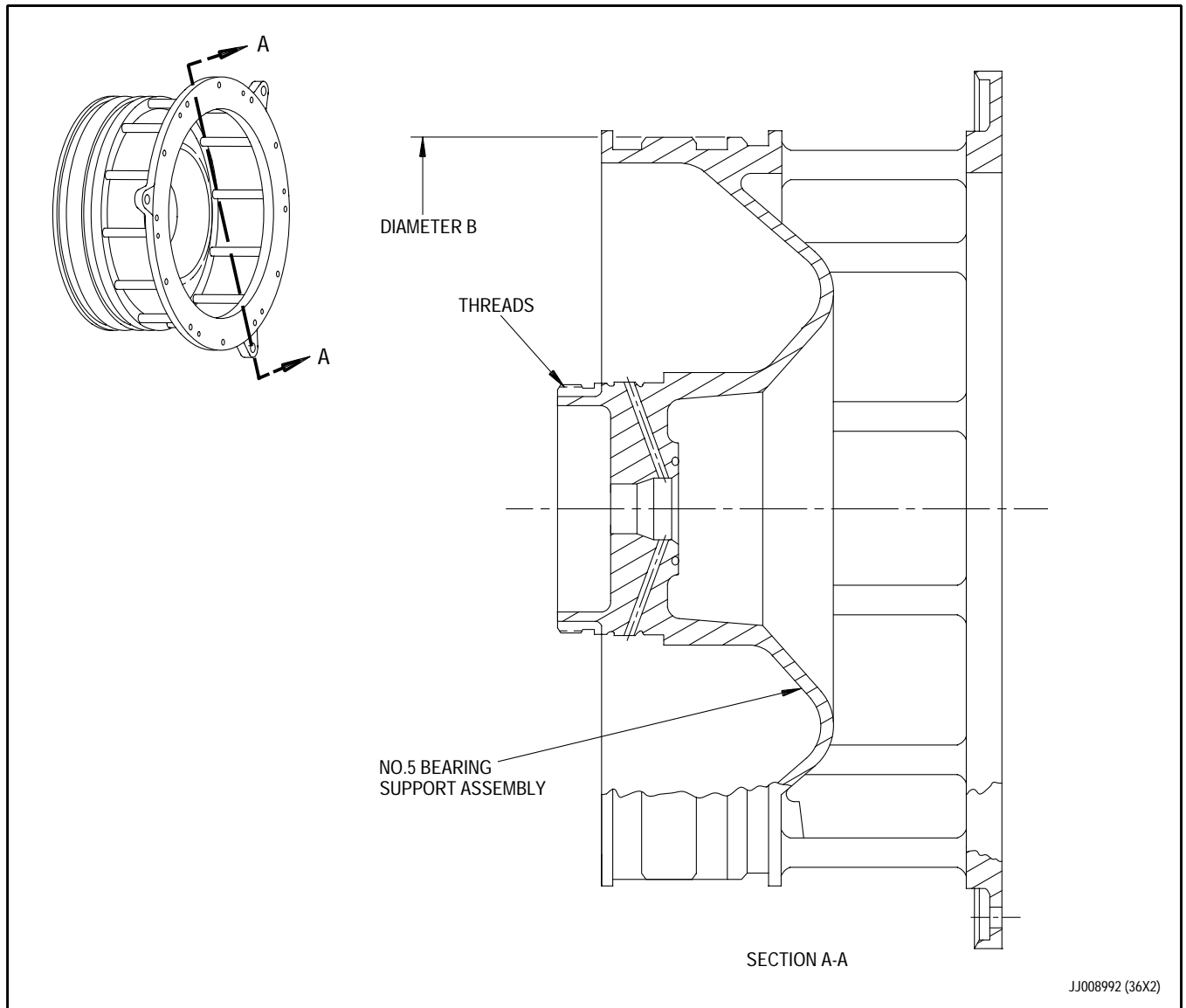
- c. Blend repair galling on Diameter B surfaces as follows:

- (1) Use fine stone.
- (2) Remove raised metal and pickup.
- (3) Blend damage up to 0.003 inch deep.

- d. Blend repair unserviceable thread damage as follows:

- (1) Use fine stone.
- (2) Remove raised metal and pickup.

- e. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9. No cracks allowed.



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Figure 1. No. 5 Bearing Support Assembly - Blend Repair

WORK PACKAGE

TECHNICAL PROCEDURES

SEAT - TURBINE SHAFT LOCK -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	0				
4 Blank	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the turbine shaft lock seat.

2. TURBINE SHAFT LOCK SEAT - BLEND REPAIR.

(See Figure 1.)

- a. Blending requirements are as follows:

- (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
- (2) Surface finish of all blends shall be as smooth or smoother than original finish.

- b. Blend repair unserviceable pits, nicks, dents, and scratches as follows (See figure 1.):

- (1) Use fine stone.
- (2) Remove raised metal and pickup over the entire lock seat surfaces as required.

- c. All blending repairs shall be fluorescent penetrant inspected to ensure cracks are not present. Refer to T.O. 2J-F100-9.

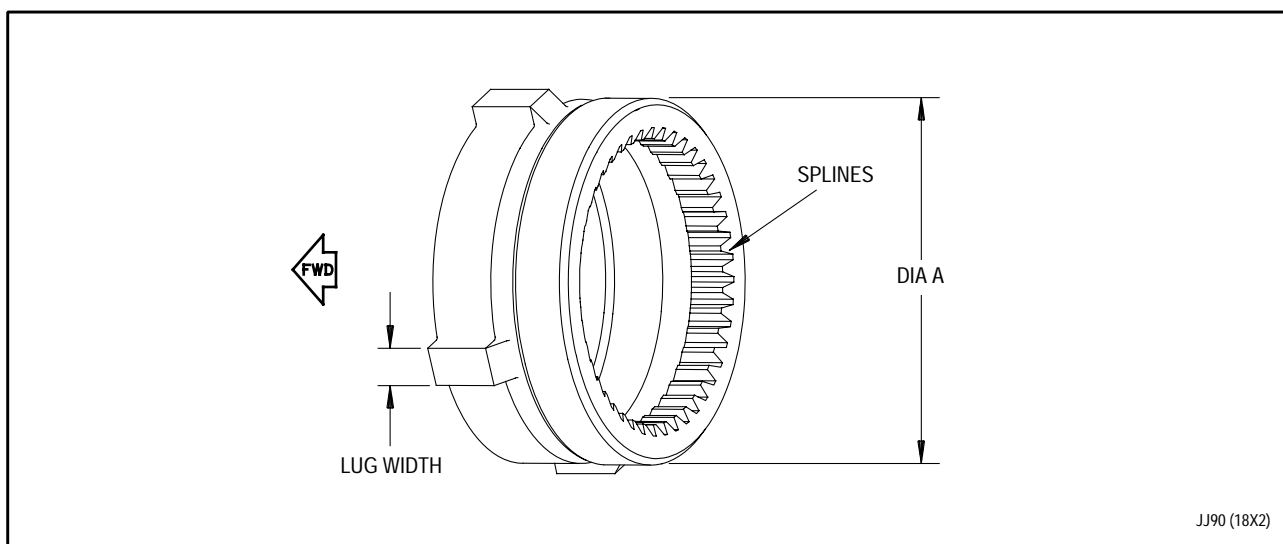


Figure 1. Turbine Shaft Lock Seat - Blend Repair

WORK PACKAGE

TECHNICAL PROCEDURES

REAR DUCT ASSEMBLY, TURBINE EXHAUST -

REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	28	4	28	5	0
3	0			6 Blank	0

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Nondestructive Inspection - - - - -	T.O. 2J-F100-9

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Rivet	AN123618	As required

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the turbine exhaust rear duct assembly.

**2. REAR TURBINE EXHAUST DUCT
ASSEMBLY - NUT PLATE REPLACEMENT.**

(See Figure 1.)

- a. Grind off upset head of rivet at two locations per nut plate(2, figure 1).
- b. Remove and discard unserviceable nut plate or retain if undamaged.
- c. Re-install serviceable nut plates(2) or install new nut plates using rivets(1). Refer to T.O. 2-1-111.

**3. REAR TURBINE EXHAUST DUCT
ASSEMBLY - BLEND REPAIR.**

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to distance of at least 15 times depth of damage from center of blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable damage on aft lip up to braze area of rear brace as follows:
 - (1) Use fine stone.
 - (2) Remove raised metal.
 - (3) Blend damage up to weld joint.
- c. Fluorescent penetrant inspect after all blending. Refer to T.O. 2J-F100-9.

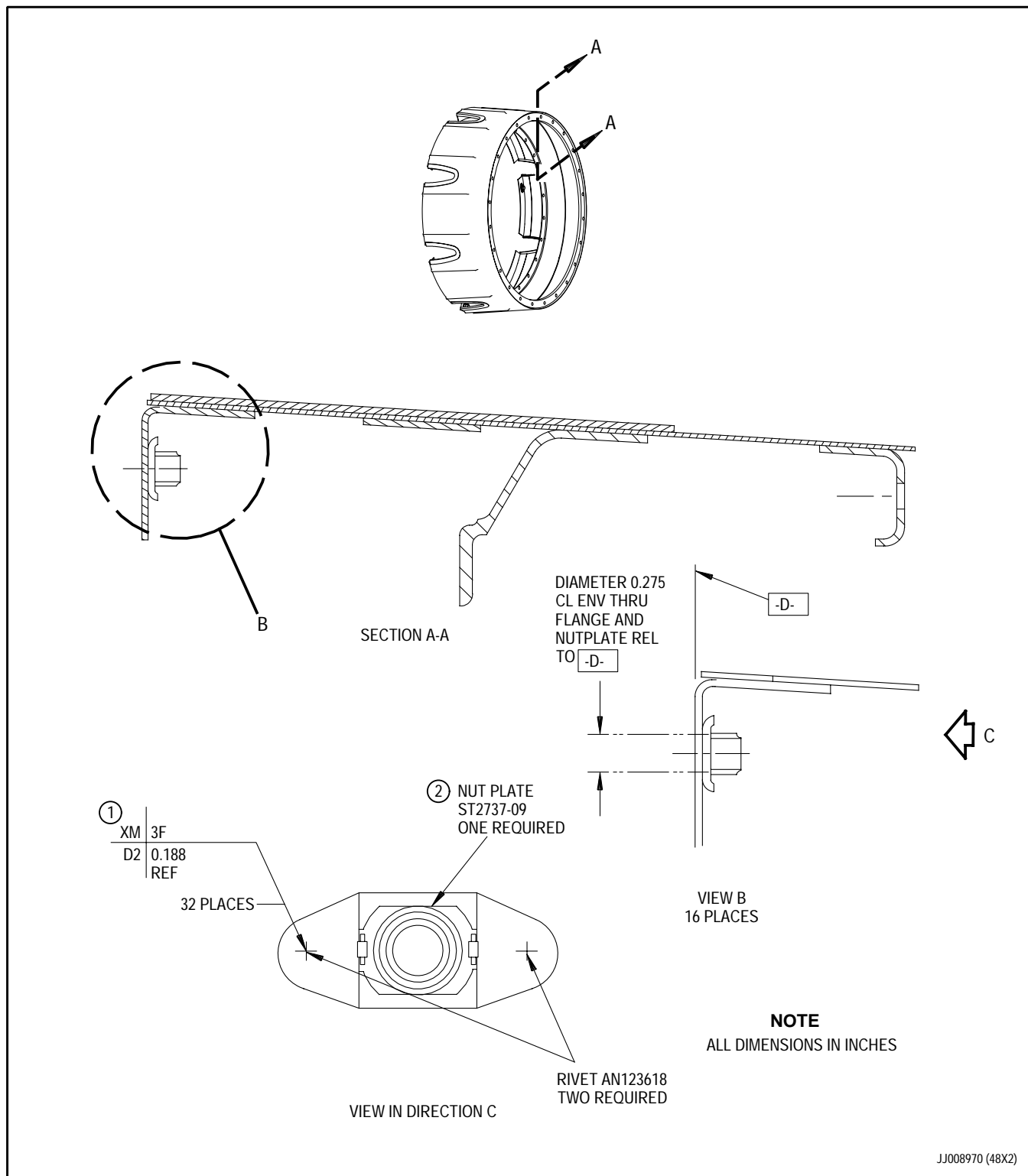


Figure 1. Rear Turbine Exhaust Duct Assembly - Nut Plate Replacement

WORK PACKAGE

TECHNICAL PROCEDURES

STIFFENERS, TURBINE SHAFT, FRONT COMPRESSOR DRIVE - REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 6					0

T.O. 2J-F100-53-9

WP 443 00

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Nondestructive Inspection - - - - -	T.O. 2J-F100-9
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Plating, Nickel, On Stainless Steel, Nickel, or Cobalt (SPOP 26) - - - - -	SWP 092 10
General Repair Procedures - Compound Antigalling (PWA 36545) Application (SPOP 748) - - - - -	SWP 098 07

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Compound, antigalling (PWA 36545)	Everlube 382

EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Rivet, solid	AN123620	32

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for repair of the front compressor drive turbine shaft stiffeners.

2. FRONT COMPRESSOR DRIVE TURBINE SHAFT STIFFENERS - BLEND REPAIR.

(See Figure 1.)

- a. Blending requirements are as follows (See figure 1.):

- (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
- (2) Surface finish of all blends shall be as smooth or smoother than original finish.

- b. Blend repair unserviceable nicks, pits and dents as follows:

- (1) Use fine stone.
- (2) Remove raised metal.
- (3) Blend repair up to 0.010 inch deep and 0.031 inch diameter and a maximum of six locations. One nick, dent, or pit up to 0.062 inch diameter is permitted.

- c. Blend repair unserviceable scratches up to 0.005 inch deep.

- d. All blending repairs shall be fluorescent penetrant inspected to ensure cracks are not present. Refer to T.O. 2J-F100-9.

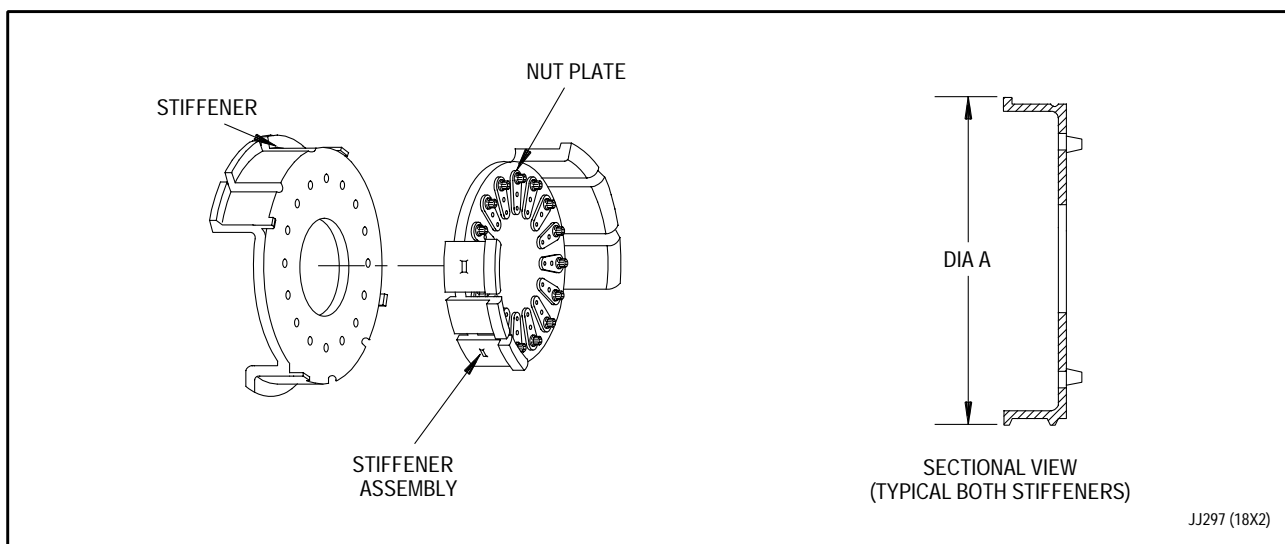


Figure 1. Front Compressor Drive Turbine Shaft Stiffeners - Blend Repair

3. FRONT COMPRESSOR DRIVE TURBINE SHAFT STIFFENERS - SNAP DIAMETER REPAIR.

(See Figure 2.)



Threads on nut plates are silver-plated. Stripping solutions will remove this silver.

- a. Remove all nut plates. (See paragraph 4.)
- b. Clean-up machine worn diameter to dimension(3). (See figure 2.)

NOTE

Stiffener parent material is stainless steel (AMS 5732).

- c. Nickel plate area shown(1). Refer to T.O. 2J-F100-53-1, SWP 092 10 (SPOP 26).
- d. Finish machine plated area to dimension(3).
- e. Install nut plates. Refer to paragraph 4.

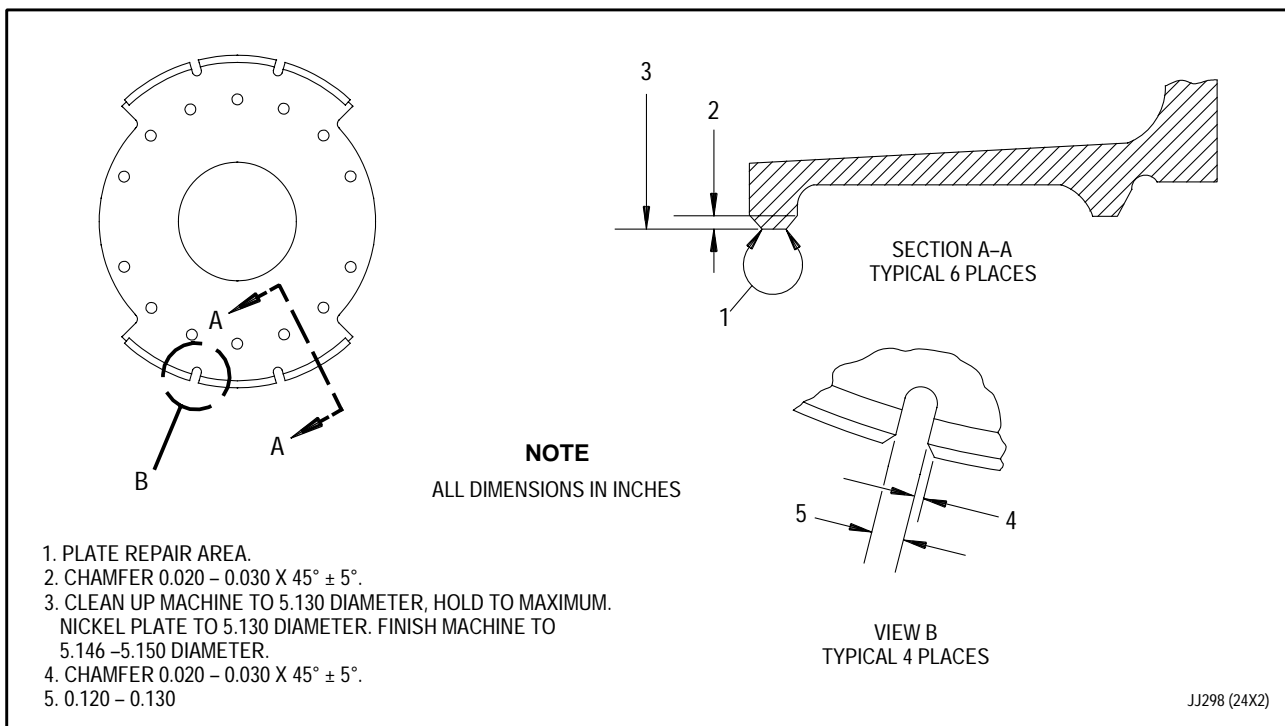


Figure 2. Front Compressor Drive Turbine Shaft Stiffeners - Snap Diameter Repair

4. FRONT COMPRESSOR DRIVE TURBINE SHAFT STIFFENER ASSEMBLY - NUT PLATE REPLACEMENT.

(See Figure 3.)

- a. Grind off upset rivet head.
(See figure 3.)
- b. Remove and discard unserviceable nut plate(2). Retain nut plate for reuse, if not damaged.

- c. Install serviceable nut plates(2) or new nut plates using rivets(1). (See figure 3.) Refer to T.O. 2-1-111.

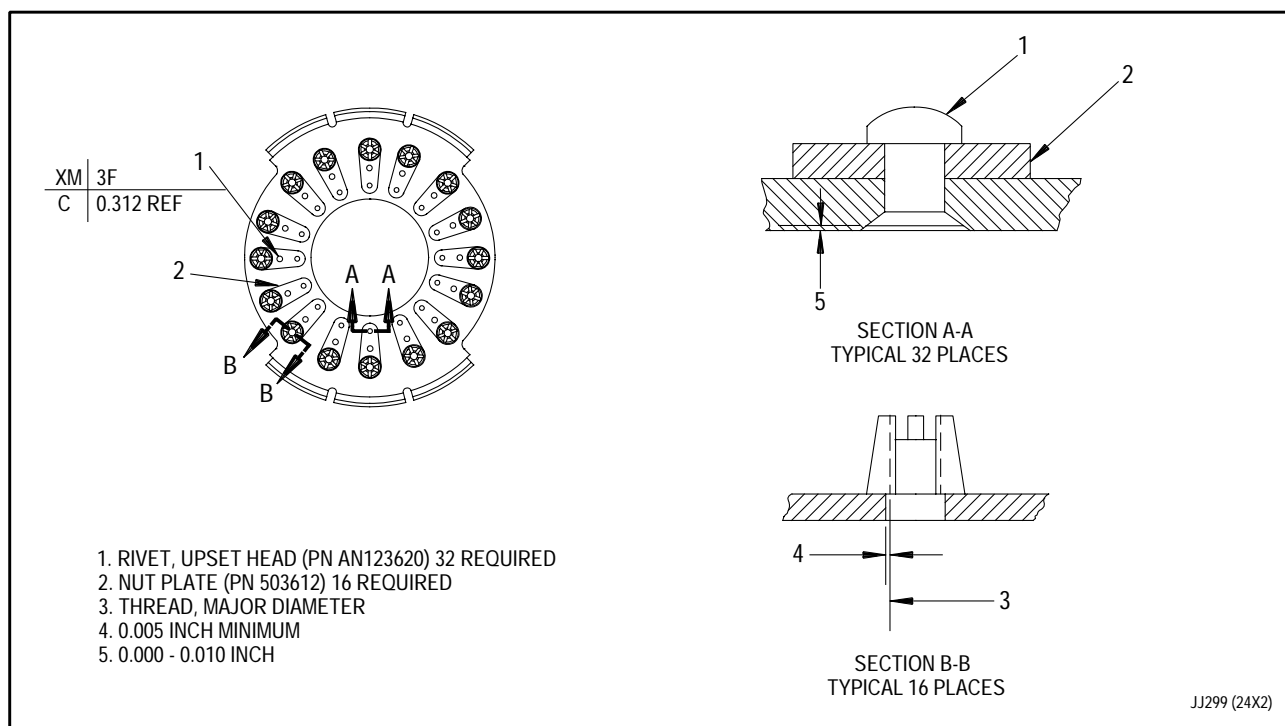


Figure 3. Front Compressor Drive Turbine Shaft Stiffener Assembly - Nut Plate Replacement

**5. FRONT COMPRESSOR DRIVE TURBINE
SHAFT STIFFENERS - ANTIGALLING
COMPOUND
APPLICATION.**

(See Figure 4.)

- a. Apply PWA 36545 antigalling compound on areas shown. (1 and 2, figure 4.) Refer to T.O. 2J-F100-53-1, SWP 098 07 (SPOP 748).

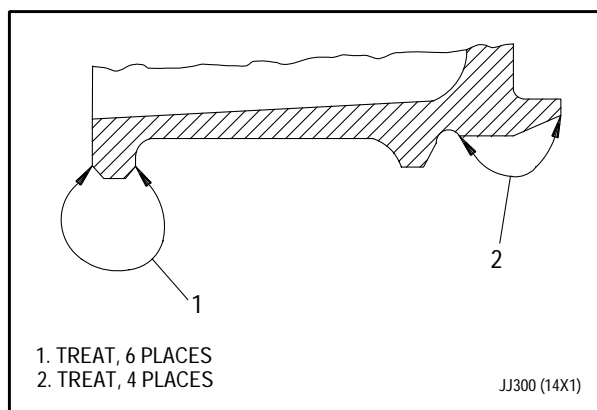


Figure 4. Front Compressor Drive Turbine Shaft Stiffeners Assembly - Antigalling Compound Application

WORK PACKAGE

TECHNICAL PROCEDURES

PLUG, NO. 5 BEARING - REPAIR

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 5	0				
6 Blank	0				

REFERENCE MATERIAL REQUIRED

Title	Number
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Plasma and Flame Spray Coating Procedures, General - - - -	WP 096 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	No. 5 Bearing Plug Plasma or Flame Spray Snap Diameter Repair	
	Fixture - - - - -	7836684
	Mask - - - - -	7836636

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains instructions for the repair of the No. 5 bearing plug.

2. NO. 5 BEARING PLUG - BLEND REPAIR.

(See Figure 1.)

- a. Blending requirements are as follows:
 - (1) All local blending shall extend to a distance of at least 15 times the depth of the damage from the center of the blend.
 - (2) Surface finish of all blends shall be as smooth or smoother than original finish.
- b. Blend repair unserviceable wear to Diameter B(6) as follows:
 - (1) Use fine stone.
 - (2) Blend uniformly around Diameter B to remove all burrs and raised metal to a maximum repair limit of 4.160 inches.
 - (3) No cracks allowed.
- c. Blend repair unserviceable nicks and scratches all over (except Diameters A(4) and B(6) and threaded hole(5)) as follows:
 - (1) Use fine stone.
 - (2) Blend to remove raised metal to a maximum repair limit of 0.010 inch in depth.
 - (3) No cracks allowed.

3. NO. 5 BEARING PLUG - THREADED HOLE REPAIR.

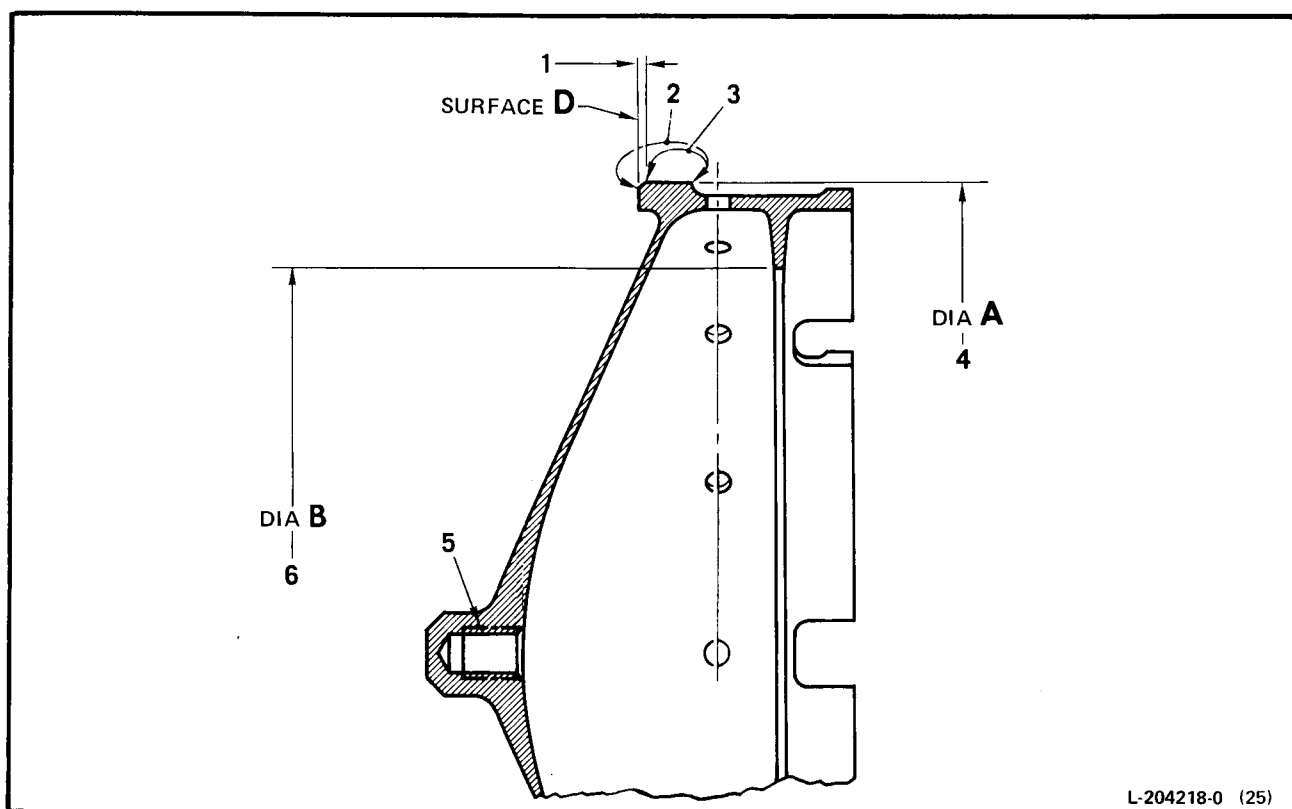
(See figure 1.)

- a. Chase threads(5) using a 0.250-28UNF-28 tap.
- b. If thread damage is not removed by chasing threads, reject plug.

4. NO. 5 BEARING PLUG - SNAP DIAMETER (DIAMETER A) - REPAIR.

(See figure 1.)

- a. Clean up machine worn snap diameter(4) using 7836684 fixture.
- b. Secure 7836636 mask and plasma spray prepared area per PWA 53-37. Refer to T.O. 2J-F100-53-1, WP 096 00.
- c. Finish machine diameter(4) using 7836684 fixture.



1. Chamfer 0.010 to 0.030 inch \times $45^\circ \pm 2^\circ$.
2. Circular runout shall be within 0.001 inch FIR in relation to Surface D and Diameter A.
3. Plasma spray per text.
4. Clean up machine to 4.904 inch diameter, hold to maximum value. Plasma spray to 4.926 inch diameter minimum. Finish machine to 4.912 to 4.914 inch diameter. This diameter shall be square with Surface D within 0.0005 inch total.
5. 0.250-28UNF-28 thread
6. 4.040 inches, maximum serviceable limit 4.160 inches, maximum reparable limit.

Figure 1. No. 5 Bearing Plug Snap Diameter Repair

WORK PACKAGE

INTRODUCTION

FAN DRIVE TURBINE MODULE -

ASSEMBLY OF SUBASSEMBLIES

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 2

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2		20			

1. INTRODUCTION.

a. This work package introduces the 600 00 through 699 00 series of work packages for assembly of

fan drive turbine module subassemblies. The following work packages are included in this series:

WP/SWP No.	Title
601 00	Shaft Assembly, Front Compressor Drive Turbine - Assembly and Dynamic Balancing
602 00	Vanes, Third Stage Turbine Stator - Assembly to Third Stage Turbine Air Sealing Ring Assembly
603 00	Disk, Blades, Air Sealing Ring, and Air Seal, Third Stage Turbine, Hub Assembly, Turbine Rear, and Tierod, Turbine - Assembly
604 00	Vanes, Fourth Stage Turbine Stator - Assembly to Fourth Stage Turbine Air Sealing Ring Assembly
605 00	Disk and Blades, Fourth Stage Turbine - Assembly
606 00	Support Assembly, No. 5 Bearing Seal - Assembly
607 00	Seal, No. 5 Bearing - Air Leak Check
608 00	Seat, Turbine Shaft Lock - Installation
609 00	Case Assembly, Turbine Exhaust - Assembly
610 00	Support Assembly - No. 5 Bearing Inner, and No. 5 Bearing Inner Race and Rollers - Assembly
611 00	Rotor and Stator Assembly, Turbine, Front Compressor Drive - Assembly
612 00	Tools, Dynamic Balancing - Installation
613 00	Rotor and Stator Assembly, Front Compressor Drive Turbine - Dynamic Balancing Check
614 00	Tools, Dynamic Balancing - Removal
615 00	Blade, Turbine Rotor, Third Stage - Moment-Weight Classification
616 00	Blade, Turbine Rotor, Fourth Stage - Moment-Weight Classification

WORK PACKAGE

TECHNICAL PROCEDURES

SHAFT ASSEMBLY, FRONT COMPRESSOR DRIVE TURBINE -

ASSEMBLY AND DYNAMIC BALANCING

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 12

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	16	5	0	9 - 11	3
3	3	6 - 8	16	12 Blank	16
4	16				

REFERENCE MATERIAL REQUIRED

Title	Number
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Marking, Temporary - - - - -	SWP 023 01
Cleaning, Alkaline Rust Remover, Long Soak (SPOP 203) - -	SWP 031 09
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Shaft Assembly, Front Compressor Drive, Turbine -	
Repair - - - - -	WP 402 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
ALCOHOL, ISOPROPYL (PMC 9094)	TT-I-735
TAPE, CLOTH	2 INCH WIDE

EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
CLIP	4044390	3

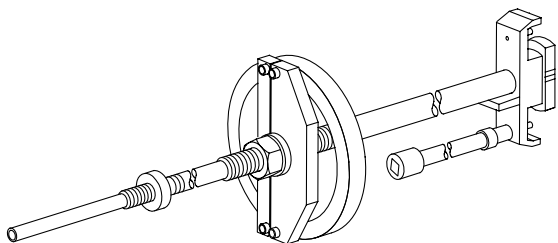
APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	FRONT COMPRESSOR DRIVE TURBINE SHAFT STIFFENER - ASSEMBLY	
	PULLER, LOW TURBINE SHAFT STIFFENERS - - - - -	PWA 50950
	EXTENSION WRENCH, COUNTERWEIGHT BOLT - - - - -	PWA 52790
	PUSHER-LPT SHAFT STIFFENERS - - - - -	PWA 56601

APPLICABLE SUPPORT EQUIPMENT (continued)

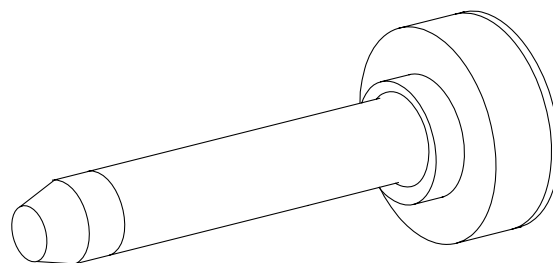
Paragraph	Function - Tool Nomenclature	Tool Number
3	FRONT COMPRESSOR DRIVE TURBINE SHAFT ASSEMBLY - DYNAMIC BALANCING	
	FRONT BALANCE ADAPTER - - - - -	PWA 52787
	REAR BALANCE ADAPTER - - - - -	PWA 52788
	FRONT AND REAR CALIBRATION WEIGHT - - - - -	PWA 55716
	REAR CALIBRATION WEIGHT - - - - -	PWA 52786
	LIGHT ASSEMBLY - - - - -	PWA 52784
	WRENCH EXTENSION - - - - -	PWA 52790

ILLUSTRATED SUPPORT EQUIPMENT



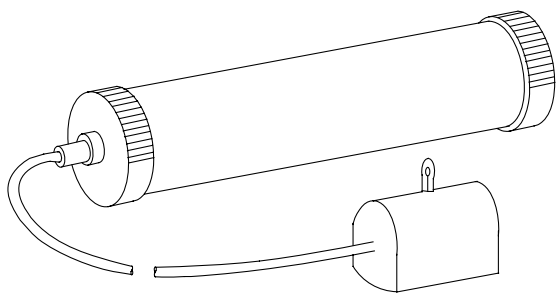
PWA 50950

Figure T1. PWA 50950 PULLER



PWA 51953 -C

Figure T2. PWA 51953 DRIFT

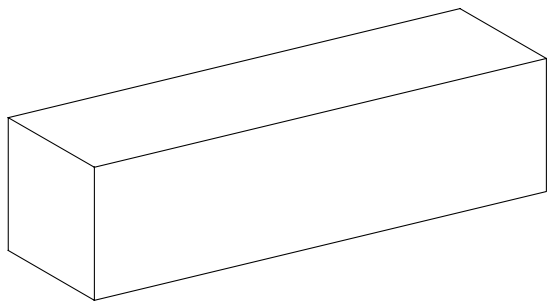


PWA 52784 -C

Figure T3. PWA 52784 LIGHT ASSEMBLY

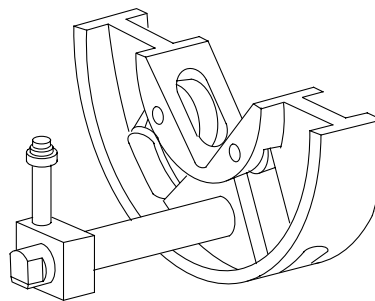
Figure T4. Deleted.

ILLUSTRATED SUPPORT EQUIPMENT (continued)



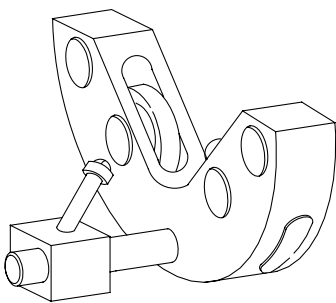
PWA 52786 -C

Figure T5. PWA 52786 REAR CALIBRATION WEIGHT



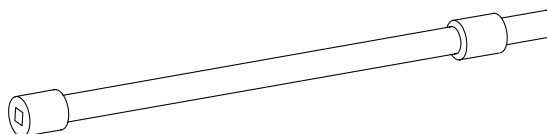
PWA 52787 -C

Figure T6. PWA 52787 FRONT BALANCE ADAPTER



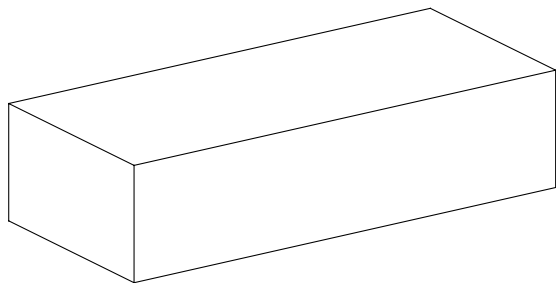
PWA 52788 -C

Figure T7. PWA 52788 REAR BALANCE ADAPTER



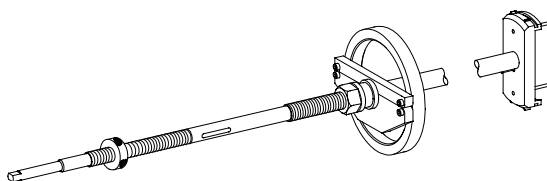
PWA 52790 -C

Figure T8. PWA 52790 EXTENSION WRENCH



PWA 55716 -C

Figure T9. PWA 55716 WEIGHT



PWA 56601 -C

Figure T10. PWA 56601 PUSHER

1. INTRODUCTION.

- a. This work package contains instructions for the assembly of stiffeners into the front compressor drive turbine shaft and dynamic balancing of shaft assembly.

2. FRONT COMPRESSOR DRIVE TURBINE SHAFT STIFFENER - ASSEMBLY.

(See Figure 1.)

a. Assemble front stiffener(2,
figure 1) as follows:

- (1) Thread ring detail of PWA 50950 puller (with bar and plate) onto rear of shaft(4). Loosen cap screw and swing plate out of way.
- (2) Position front stiffener on puck detail of puller with smaller OD toward puck.
- (3) Secure stiffener to puck by tightening cam to expand jaws to grab stiffener.
- (4) Unlock puck detail of puller by loosening knurled nut and sliding tube detail back along inner rod. Secure tube in position by engaging dowel pin with slot in tube.

NOTE

Front stiffener shall be cocked at angle to pass interference diameter where stiffeners seat. Puck detail being unlocked allows stiffener to be cocked.

- (5) Insert assembly through rear of shaft until it passes interference diameter of stiffener seat.

- (6) Rotate stiffener into installation position by releasing tube from dowel pin lock and sliding it against puck. Tighten knurled nut to secure.
- (7) Mark location of master splines (two widest splines) on turbine shaft, 180 degrees apart, on flange rearward of splines.
- (8) Position stiffener in shaft so that any one screw hole is aligned 180 degrees opposite temporary marking.
- (9) Swing plate detail into position so that it sits in groove of hex nut. Secure by tightening cap screw.



To prevent damage to stiffener do not use excessive force when pulling stiffener to seat. Light force is sufficient to seat stiffener.

- (10) Pull stiffener to seat by turning hex nut in clockwise direction.

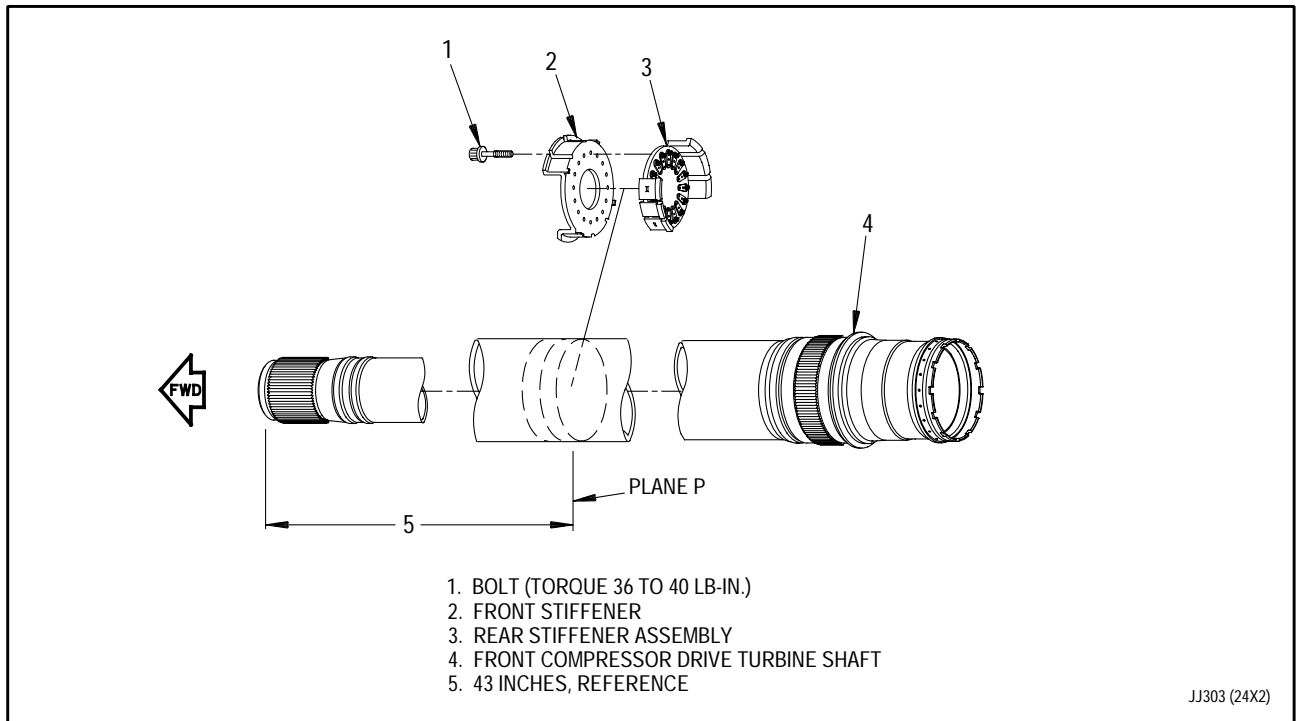


Figure 1. Front Compressor Drive Turbine Shaft Stiffeners - Assembly

- (11) Use detail wrench and PWA 52790 extension through front end of shaft to loosen cam of PWA 50950 puller.
- (12) Using light and long handle mirror, ensure puller jaws are disengaged from front stiffener.
- (13) Remove puller from shaft.
- b. Assemble rear stiffener(3) as follows:
 - (1) Thread ring detail of PWA 56601 pusher (with bar and plate) onto rear of shaft(4). Loosen cap screw and swing plate out of way.
 - (2) Check condition of PN MS9021-278 packing on adapter detail of pusher. Replace as required.
 - (3) Seat rear stiffener on adapter with legs of stiffener facing tool.
 - (4) Unlock adapter detail of pusher by loosening knurled nut and sliding tube detail back along inner rod.
 - (5) Install assembly through rear of shaft to point where stiffeners seat.

- (6) Position stiffener in square attitude to be seated by locking adapter detail. Lock adapter by sliding tube down against adapter and tighten knurled nut.
- (7) Position legs of rear stiffener at right angles to legs of front stiffener. Engage tool pins into holes in front stiffener.
- (8) Position plate detail so that it sits in groove of hex nut on pusher.



To prevent damage, do not use excessive force when pushing stiffener to seat. Light force is enough.

- (9) Push stiffener to seat by turning hex in counterclockwise direction.
- (10) Loosen cap screw and swing plate detail out of way.
- (11) Unlock adapter detail of pusher by loosening knurled nut and tube detail back along inner rod. Pull tool to disengage adapter from stiffener.
- (12) Remove pusher, ring, bar and plate from rear of shaft.

- c. Secure stiffeners together with 16 PN MS9556-08 bolts(1) using PWA 52790 extension and detail-2 socket. Torque bolts 36 to 40 pound-inches.
- d. Dynamic balance shaft assembly per paragraph 3.

3. FRONT COMPRESSOR DRIVE TURBINE SHAFT ASSEMBLY - DYNAMIC BALANCING.

(See Figure 2.)

NOTE

Paint on balance journal shall be removed to prevent buildup which could cause an inaccurate balancing.

- a. Remove paint in Diameter B area. (See figure 2.) Refer to T.O. 2J-F100-53-1, SWP 031 09 (SPOP 203).
- b. Mount shaft in balance machine on Diameter A with PWA 52787 balance adapter and Diameter B with PWA 52788 balance adapter. Install periphery tape(4).
- c. Calibrate hard bearing balance machine per manufacturer's instructions. Console is precalibrated. No calibration weights are required.

- d. Calibrate soft bearing balance machine per manufacturer's instructions. Use following calibration weights.
- (1) PWA 55716 calibration weight marked REAR for Planes D and M. Use 10.0 ounce-inch for Plane D and 10.2 ounce-inch for Plane M.
 - (2) PWA 52786 calibration weight (1.0 ounce-inch) for Planes D and M.
-
- Do not attach calibration weight to area where material has been removed.
- e. Balance shaft assembly by running balance machine at 600 rpm minimum. Dynamic unbalance shall not exceed 0.05 ounce-inches at Plane D with shaft rotating at 600 rpm minimum.
- f. Use temporary marking procedures to mark point of most initial unbalance. Refer to T.O. 2J-F100-53-1, SWP 023 01.
- g. Correct unbalance by adding counterweights in Plane D.
- h. At plane M, mark at heavy angle (± 5 degrees), and at axial location(10), the residual unbalance value to the nearest 0.01 ounce-inch. Residual unbalance shall not exceed 2.2 ounce-inches. Refer to T.O. 2J-F100-53-1, SWP 023 01.
- i. Use PWA 52784 light assembly and PWA 52790 extension wrench to add counterweights at Plane D by removing PN MS9556-08 bolt or bolts securing stiffeners and installing appropriate counterweight assemblies which include PN 4044390 clips and PN 4044389 bolts. Torque bolts 36 to 40 pound-inches.
- j. Counterweights may be machined to minimum dimensions(6, 7, and 8) if necessary. Use weight in combination but do not exceed maximum quantity.
- k. After acceptable balance has been obtained, check machine set-up as follows:
- (1) Attach balance weights to shaft OD with four wraps of two inch wide cloth tape.
 - (2) Attach PWA 52786 calibration weight at Plane M on or near heavy or light unbalance angle.
 - (3) Run machine. Check unbalance to be:
Residual unbalance at Plane M $+1.0 \pm 0.1$ ounce-inch at heavy angle
or
Residual unbalance at Plane M -1.0 ± 0.1 ounce-inch at light angle.

- (4) Remove calibration weight.
- (5) Attach PWA 52786 calibration weight at Plane D on or near heavy or light unbalance angle.
- (6) Run machine. Check balance to be:
1.0 \pm 0.1 ounce-inch at heavy angle
or
0.9 \pm 0.1 ounce-inch at light angle
- (7) Remove calibration weight.
- l. Remove periphery tape. Use isopropyl alcohol to remove all tape residue on shaft OD from periphery tape and from cloth tape at Planes D and M.
- m. Remove shaft from balance machine.
- n. Install protector on shaft front splines and on rear of shaft.
- o. Paint Diameter B and areas where material was removed. Apply antigalling compound. Refer to WP 402 00.

Legend for figure 2

1. 61.050 to 62.050 inch
2. 41.675 to 42.675 inch
3. 12 slots
4. Periphery tape. Align zero with 1 of 12 slots (3).
5. Balance weight

<u>PN</u>	<u>Class</u> <u>(oz.-in.)</u>	<u>Maximum</u> <u>Permissible</u> <u>Number</u>
4044394	1	0 - 7
4044395	2	0 - 4
4044393	4	0 - 2

6. 0.400 inch minimum if machining is required.
7. 0.800 inch minimum if machining is required.
8. 0.540 inch diameter minimum if machining is required.
9. 5.50 inch minimum
10. Mark unbalance per text.

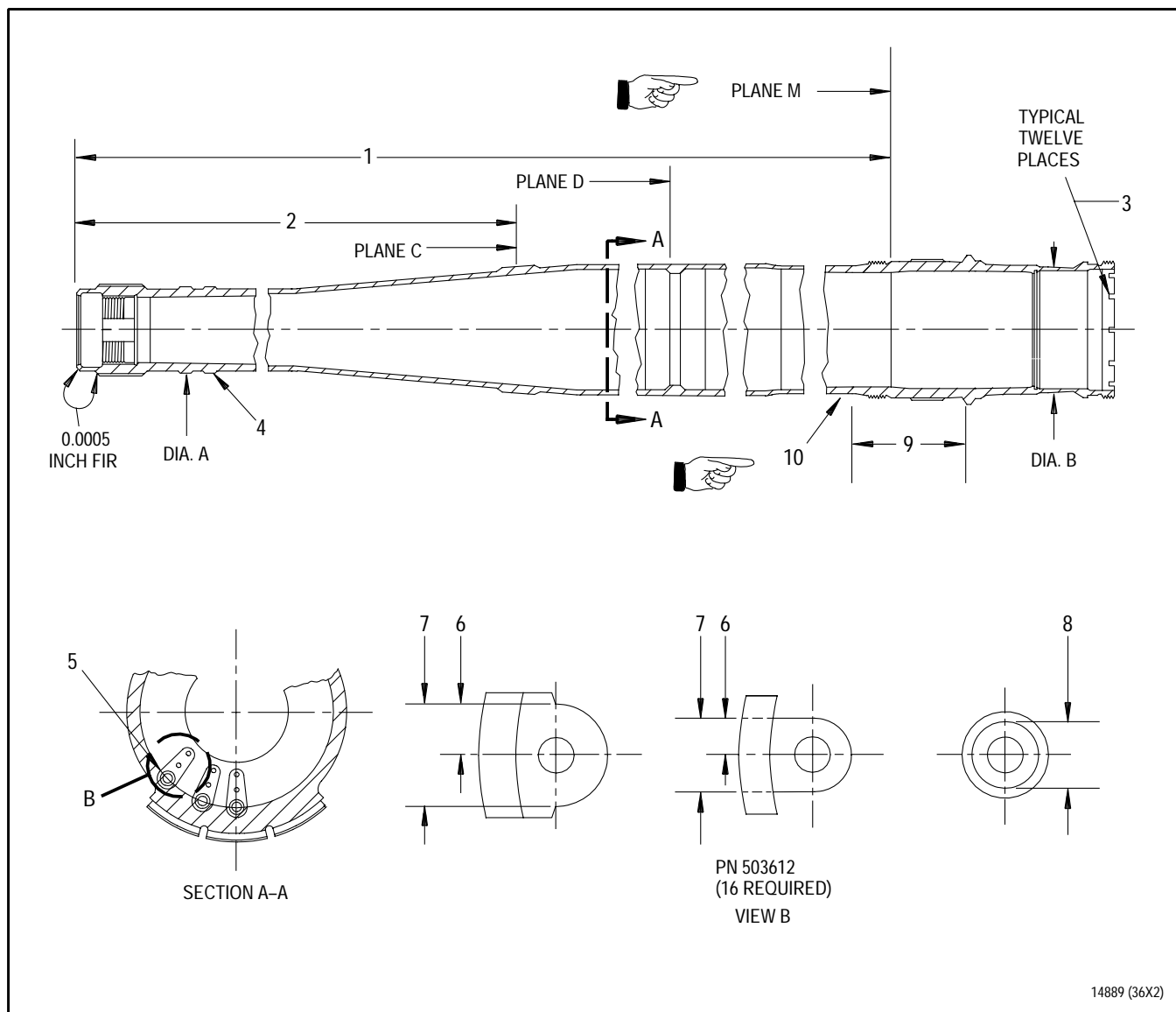


Figure 2. Front Compressor Drive Turbine Shaft Assembly - Dynamic Balance

WORK PACKAGE

TECHNICAL PROCEDURES

**VANES, THIRD STAGE TURBINE STATOR -
ASSEMBLY TO THIRD STAGE TURBINE
AIR SEALING RING ASSEMBLY**

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	28	3	11	4 - 8	28

REFERENCE MATERIAL REQUIRED

Title	Number
Illustrated Parts Breakdown - - - - -	T.O. 2J-F100--54

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T.O. No.	Date	Level	Title (ECP No.)
2J-F100229(III)-527	15 Jan 1997	D	Installation of Improved Margin Fan Drive Turbine Fasteners, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 95QA087)

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Oil, lubricating	MIL-L-7808

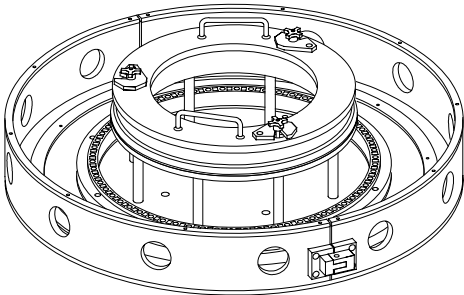
EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Collar - pin, rivet or Nut - self-locking, hex Pin - rivet Bolt	4061774 or 4082753-01 4074848 ST2164-020	62 62 62 62

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
3	Third Stage Turbine Stator Vanes - Assembly With Third Stage Turbine Air Sealing Ring Assembly. Support, Build - Pin and Collar Installation, 3rd and 4th Stage Turbine Vane, - - - - -	PWA 57913

ILLUSTRATED SUPPORT EQUIPMENT



PWA 57913 -C

Figure T1. PWA 57913 SUPPORT

1. INTRODUCTION.

- a. This work package contains instructions for assembling 3rd stage turbine vanes to 3rd stage turbine air sealing ring assembly.

borescope plug hole, seven have FTIT thermocouple holes, and remaining 23 have no holes. These vanes must be placed at proper positions in turbine nozzle so that FTIT thermocouples and borescope plug can be installed. See table 1 for summary of vanes and their features.

2. GENERAL.

(See Table 1.)

- a. There are 31 vanes in 3rd stage turbine nozzle. One has

Table 1. Third Stage Turbine Vane Identifying Features

Part Number	Identifying Features	Application	Quantity
4077373	No holes in outer shroud	All locations except borescope and FTIT thermocouple	23
4077443	Raised boss on outer shroud. Boss has 0.098 to 0.104 inch diameter hole. Two holes on convex side of one airfoil.	FTIT thermocouple locations	7
4077423	0.370 to 0.375 inch diameter hole in outer shroud	Borescope plug location	1

3. THIRD STAGE TURBINE STATOR VANES - ASSEMBLY WITH THIRD STAGE TURBINE AIR SEALING RING ASSEMBLY.

(See Figures 1 through 3.)



Failure to verify PNs may result in configuration mismatch and cause engine damage or failure.

- a. Verify correct 3rd stage stator vanes are used to maintain configuration. Refer to T.O. 2J-F100-54.

NOTE

- The larger outer split ring assembly (6, figure 3) of PWA 57913 support can be removed and set aside to provide greater access to the build area.
 - Two fastener configurations exist. One uses bolts with self-locking nuts. The other uses rivet pins with either collars or self-locking nuts to secure 3rd stage turbine stator vanes to 3rd stage turbine air sealing ring.
- b. For bolt with self-locking nut configuration, secure vanes to air sealing ring as follows:
 - (1) Arrange vanes(4, figure 1) trailing edge up on bench in order marked at disassembly. Ensure vanes are in proper sequence. (See figure 2.)
 - (2) Place PWA 57913 support on suitable bench or tabletop.
 - (3) Lubricate threads of 62 bolts(2, figure 1) with MIL-L-7808 engine oil and install with heads into bolt head pockets machined in lower assembly ring(detail -4).

- (4) Line up X mark on front face of air sealing ring with scribe line on detail -4 which points to one of the rivets. Install ring with forward face down over 62 bolts and down against top surface of assembly ring.
- (5) Starting at scribe lines, install borescope vane leading edge down, at scribe line location. Arrange remainder of vanes around air sealing ring in proper sequence. Outer edge of vanes must rest on nylon support pad(5, figure 3).
- (6) Install spacers(3, figure 1) on bolts.
 - (a) Tighten shoulder bolt(detail -10) in center of base to prevent rotation during final torque.
- (7) Install self-locking nuts(6) on bolts(2). Verify run-on torque is between 1.5 and 7.0 pound-inches using standard torque wrench on self-locking nut while PWA 57913 support is holding bolt stationary. Discard nut if run-on torque is not within 1.5 to 7.0 pound-inch limit.



Exceeding torque limits can cause bolt stress or fracture causing severe engine damage.

- (8) Apply final torque, 23 to 27 pound-inches, to nuts.
- (9) Check for loose assemblies. Replace if not tight.

NOTE

Rivet pins(2A) may be secured using either pre-sheared collars(5) or self-locking nuts(6).

c. For rivet pin with collar or self-locking nut configuration, secure vanes to air sealing ring as follows:

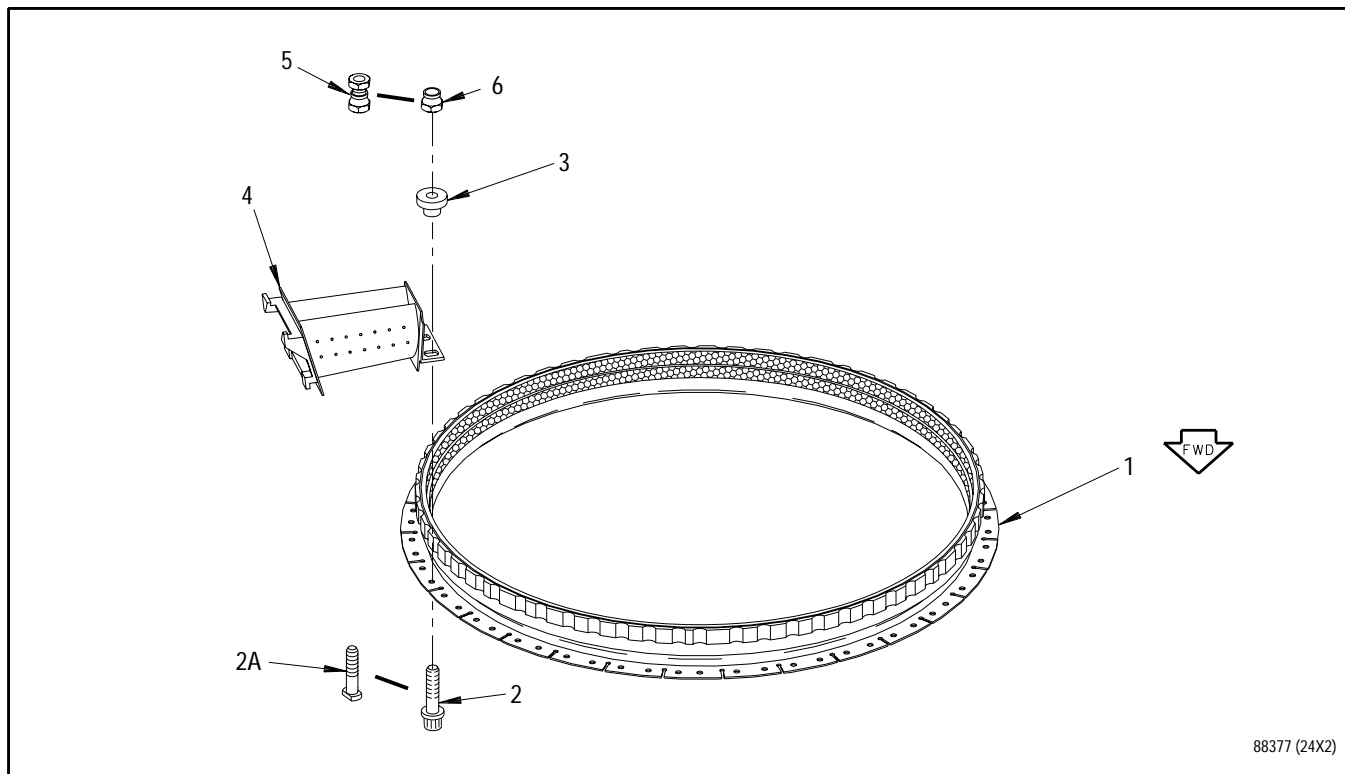
- (1) Verify correct rivet pins(2A) are used by checking for two wrenching flats on pin heads. If heads do not have wrench flats, replace with proper parts.
- (2) Arrange vanes(4, figure 1) trailing edge up on bench in order marked at disassembly. Ensure vanes are in proper sequence. (See figure 2.)
- (3) Place PWA 57913 support on suitable bench or tabletop.
- (4) Install 62 rivet pins(2A, figure 1) with heads into rivet pin head pockets machined in lower assembly ring(detail -4).
- (5) Line up X mark on front face of air sealing ring with scribe line on detail -4 which points to one of the rivets. Install ring with forward face down over 62 rivet pins and down against top surface of assembly ring.
- (6) Starting at scribe lines, install borescope vane leading edge down, at scribe line location. Arrange remainder of vanes around air sealing ring in proper sequence. Outer edge of vanes must rest on nylon support pad(5, figure 3).

- (7) Install spacers(3, figure 1) on rivet pins.
 - (a) Tighten shoulder bolt(detail -10) in center of base to prevent rotation during final torque.
- (8) If using collars(5), pre-shear heads from collars using standard wrenches on two collar wrench flats.
- (9) Install pre-sheared collars(5) or self-locking nuts(6) on rivet pins. Verify run-on torque is between 1.5 and 7.0 pound-inches using standard torque wrench on collar or nut while rivet pin is held stationary by PWA 57913 support. Discard collar or nut if run-on torque is not within 1.5 to 7.0 pound-inch limit.



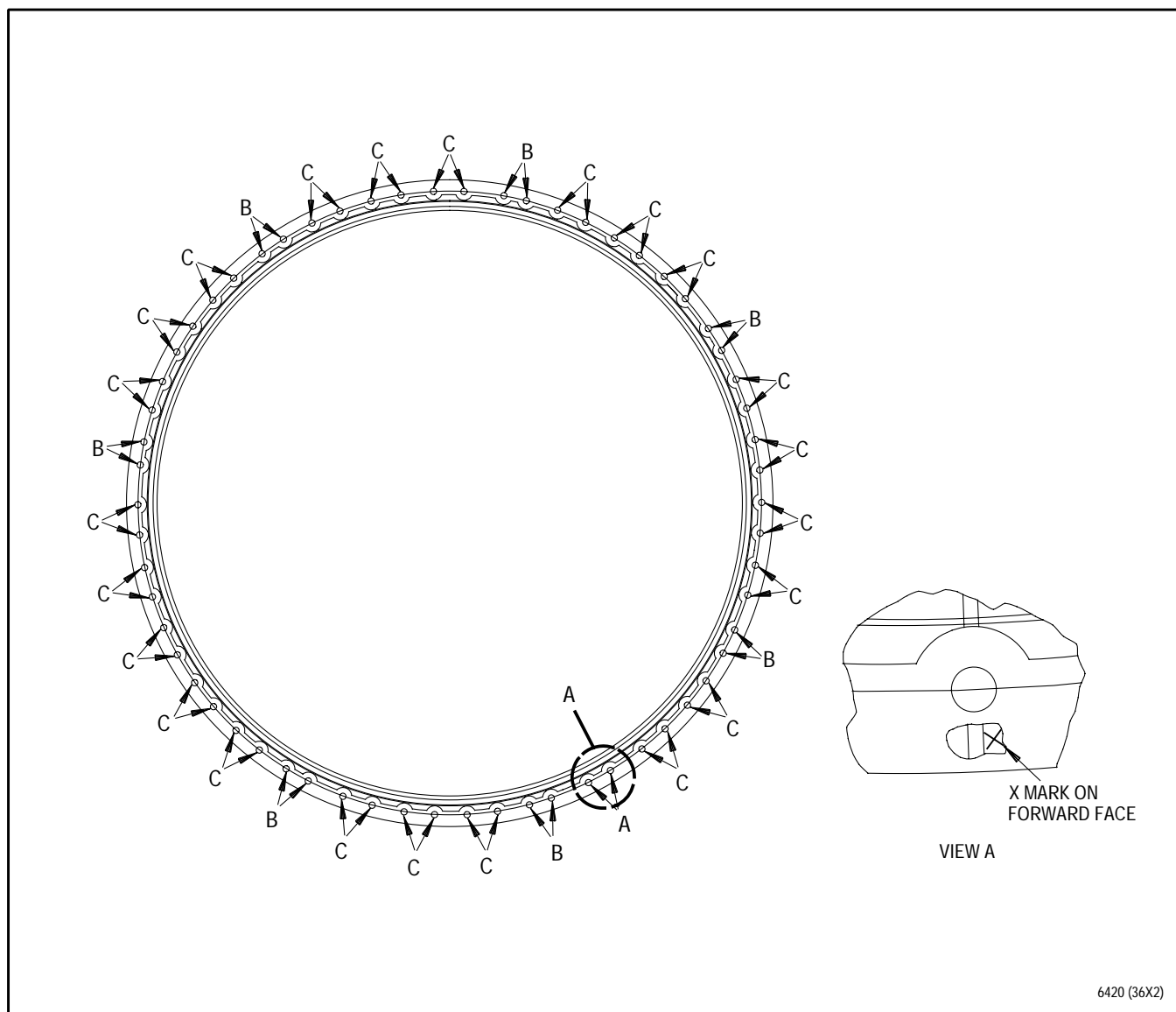
Exceeding torque limits can cause rivet pin fracture and severe engine damage.

- (10) Apply final torque of 23 to 27 pound-inches to collars or nuts.
- (11) Check for loose assemblies. Replace if not tight.



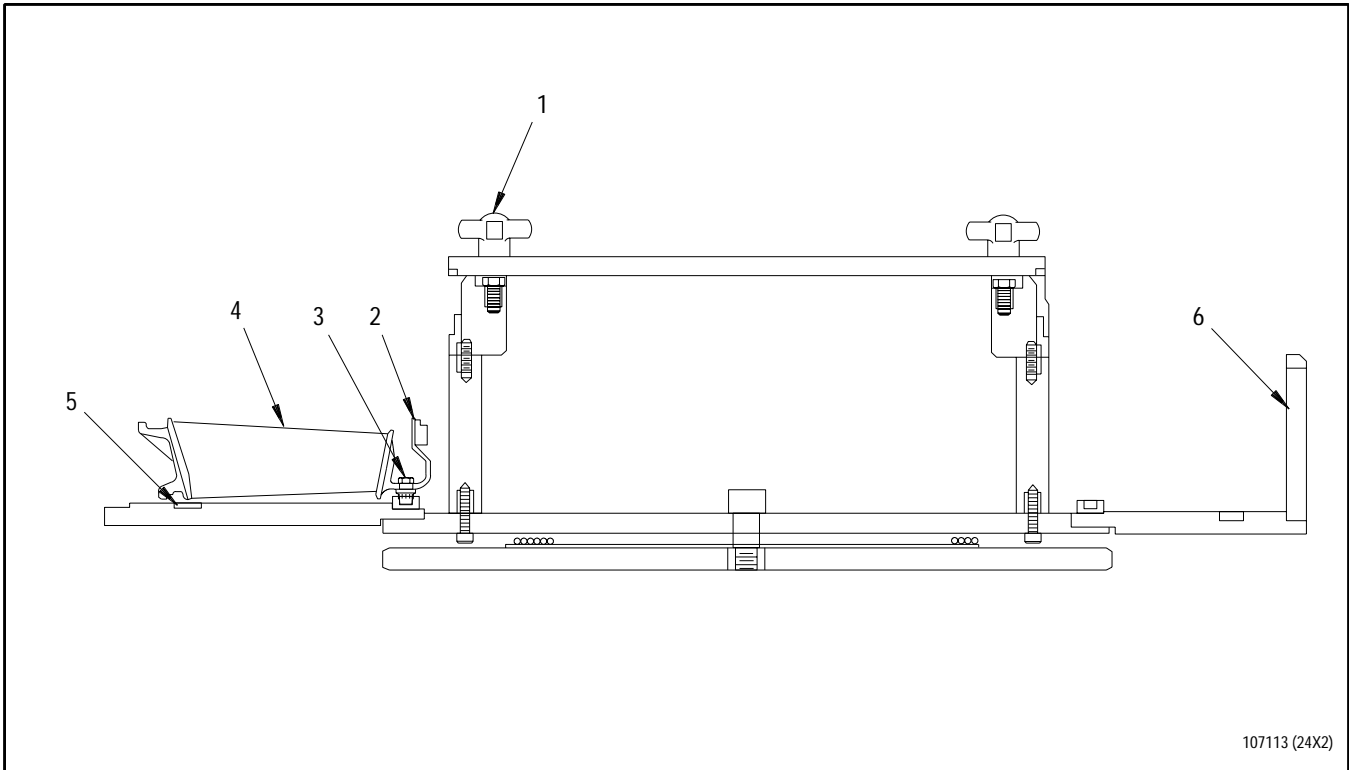
- 1. Third stage turbine air sealing ring assembly
- 2. Bolts
- 2A. Rivet pins
- 3. Sleeve spacers
- 4. Third stage turbine stator vanes
- 5. Rivet pin collars
- 6. Nuts

Figure 1. Third Stage Turbine Stator Vanes - Assembly to Third Stage Turbine Air Sealing Ring



- A. Third stage turbine stator vane, 1 required (PN 4077423)
- B. Third stage turbine stator vane, 7 required (PN 4077443)
- C. Third stage turbine stator vane, 23 required (PN 4077373)

Figure 2. Vane Arrangement (Viewed From Rear)



- | | |
|---|------------------------------------|
| 1. Hand knob, detail -26 | 4. Third stage turbine stator vane |
| 2. Third stage turbine stator vane air seal | 5. Pad, detail -2 |
| 3. Fastener | 6. Split ring, detail -32 |

**Figure 3. Third Stage Turbine Stator Vanes -
Installation to Third Stage Turbine Air Sealing Ring Assembly
Using PWA 57913 Support**

4. FOLLOW-ON MAINTENANCE.

- a. Install 3rd stage turbine stator assembly per WP 611 00.

WORK PACKAGE**TECHNICAL PROCEDURES**

**DISK, BLADES, AIR SEALING RING, AND AIR SEAL,
THIRD STAGE TURBINE, HUB ASSEMBLY,
TURBINE REAR, AND TIEROD, TURBINE -**

ASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 26

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	30	6	13	14B Added	27
2	27	7 - 9	0	15	27
3	30	10	29	16	30
4	21	11 - 13	20	17	27
4A Added	19	14	27	18 - 19	19
4B Blank Added	19	14A	30	20 - 21	13
5	30			22 Blank	0

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Disk, Blade, Air Sealing Ring, and Air Seal, Third Stage Turbine, and Tierod, Turbine - Disassembly - - - - -	WP 022 00
Blade, Turbine Rotor, Third Stage - Inspection - - - - -	WP 313 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T. O. No.	Date	Level	Title (ECP No.)
2J-F100229-553	15 FEB 95	O/I	Modification of PWA 57653 Tool Set, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 94QC004-1)
2J-F100229(III)-503	15 MAR 98	D	Rework of Rear Turbine Hub to Ease Assembly, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 90QA132)
2J-F100229(III)-527	15 JAN 97	D	Installation of Improved Margin Fan Drive Turbine Fasteners, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 95QA087)

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Compound, antigalling (PWA 36053-3)	Loctite Nickel Anti-seize 771
Compound, antigalling (PWA 36545-3)	EsnaLube 382
Pencil (crayon), silver, metal marking (hard)	Colorbrite No. 2101 or Color-Tex No. 1843 or Anadel No. 1936
Oil, lubricating	MIL-L-7808

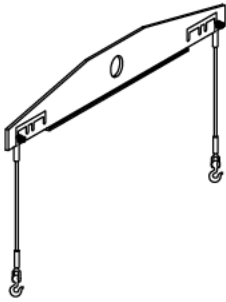
EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Collar - pin, rivet or	4061774 or	14
Nut - self-locking, hex	4082753-01	14
Packing	MS9386-010	24
Pin - rivet	4077452	14
Bolt	4084102	14
Nut - self-locking, hex	4083241	14

APPLICABLE SUPPORT EQUIPMENT

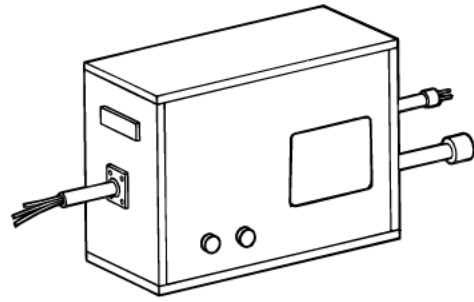
Paragraph	Function - Tool Nomenclature	Tool Number
2	THIRD STAGE TURBINE BLADES - INSTALLATION	
	TOOL SET, FAN DRIVE TURBINE ROTOR, ASSEMBLY/ DISASSEMBLY - - - - -	PWA 57810 OR
	SET, TOOL, FAN DRIVE TURBINE ROTOR ASSY - - - - -	PWA 57653
4	THIRD STAGE TURBINE AIR SEALING RING ASSEMBLY - INSTALLATION	
	HEATER, TURBINE HUB - - - - -	PWA 56326 OR
	HEATER, TURBINE HUB - - - - -	PWA 51765
5	TURBINE TIERODS - INSTALLATION	
	SLING, HANDLING - - - - -	PWA 6580
	CLAMP, 3RD STAGE TURBINE LIFT AND TURN - - - - -	PWA 53373
	SUPPORT, RETAINING NUTS, TURBINE TIEROD - - - - -	PWA 57908 OR
	TOOL, ASSEMBLY, LOW TURBINE TIERODS (PART OF PWA 57810 TOOL SET) - - - - -	PWA 57528
	TOOL SET, FAN DRIVE TURBINE ROTOR, ASSEMBLY/ DISASSEMBLY - - - - -	PWA 57810 OR
	SET, TOOL, FAN DRIVE TURBINE ROTOR ASSY - - - - -	PWA 57653
	GAGE, TIEROD STRETCH INSTALLED LPT - - - - -	PWA 500047
6	TURBINE REAR HUB ASSEMBLY - INSTALLATION	
	PUMP, HYDRAULIC - - - - -	PWA 51946
	HEATER, TURBINE EXHAUST CASE - - - - -	PWA 57886 OR
	HEATER, TURBINE EXHAUST CASE - - - - -	PWA 56322 OR
	HEATER, TURBINE REAR HUB - - - - -	PWA 51777
	TOOL SET, FAN DRIVE TURBINE ROTOR, ASSEMBLY/ DISASSEMBLY - - - - -	PWA 57810 OR
	SET, TOOL, FAN DRIVE TURBINE ROTOR ASSY - - - - -	PWA 57653
	CONTROL, HEATER - - - - -	PWA 61685 OR
	CONTROL, HEATER - - - - -	PWA 25672

ILLUSTRATED SUPPORT EQUIPMENT



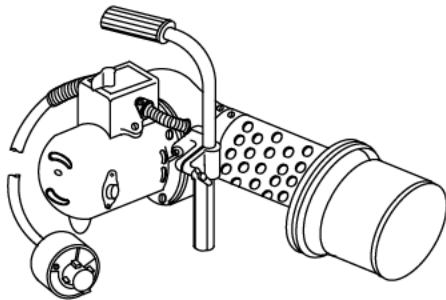
PWA 6580 -C

Figure T1. PWA 6580 SLING



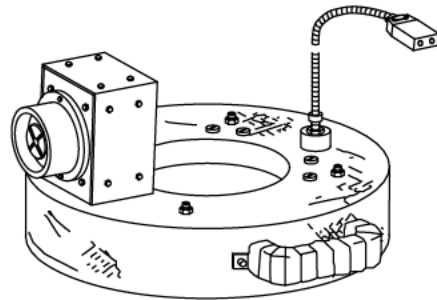
PWA 25672 -C

Figure T2. PWA 25672 CONTROL



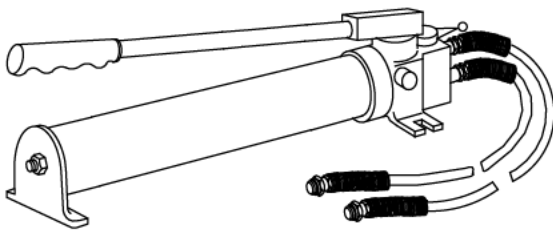
PWA 51765 -C

Figure T3. PWA 51765 HEATER



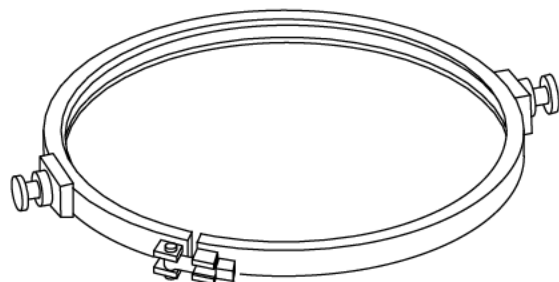
PWA 51777 -C

Figure T4. PWA 51777 HEATER



PWA 51946 -C

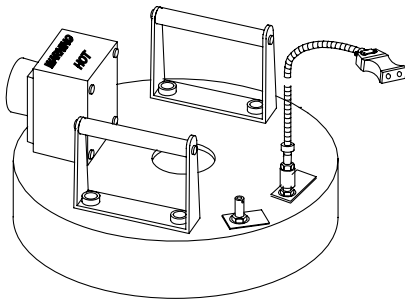
Figure T5. PWA 51946 PUMP



PWA 53373 -C

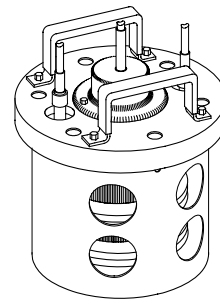
Figure T6. PWA 53373 CLAMP

ILLUSTRATED SUPPORT EQUIPMENT (continued)



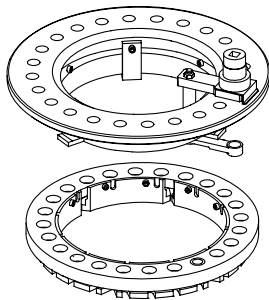
PWA 56322 -C

Figure T7. PWA 56322 HEATER



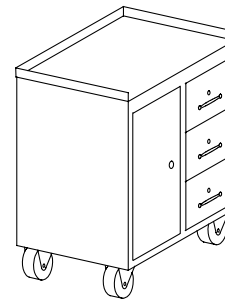
PWA 56326 -C

Figure T8. PWA 56326 HEATER



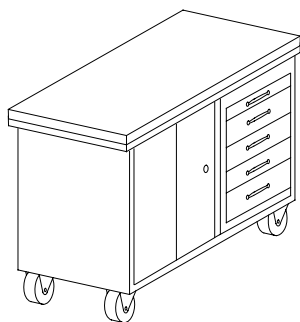
PWA 57528 -C

Figure T9. PWA 57528 TOOL



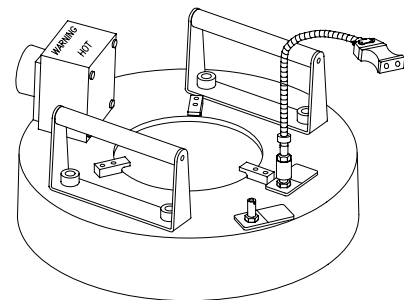
PWA 57653 -C

Figure T10. PWA 57653 SET



PWA 57810 -C

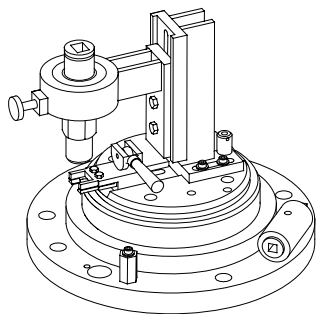
Figure T11. PWA 57810 TOOL SET



PWA 57886 -C

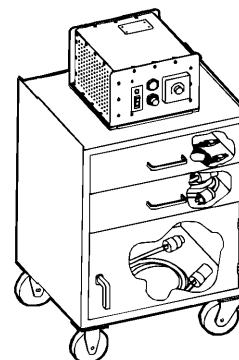
Figure T12. PWA 57886 HEATER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



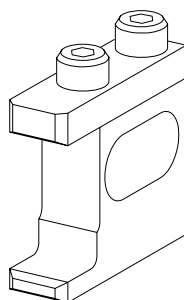
PWA 57908 -C

Figure T13. PWA 57908 SUPPORT



PWA 61685 -C

Figure T14. PWA 61685 CONTROL



PWA 500047 -C

Figure T15. PWA 500047 GAGE

1. INTRODUCTION.

a. This work package contains instructions for assembling following major parts onto 3rd stage turbine disk:

- Third stage turbine blades
- Third stage turbine air seal
- Third stage turbine air sealing ring
- Turbine tierods
- Turbine rear hub

2. THIRD STAGE TURBINE BLADES - INSTALLATION.

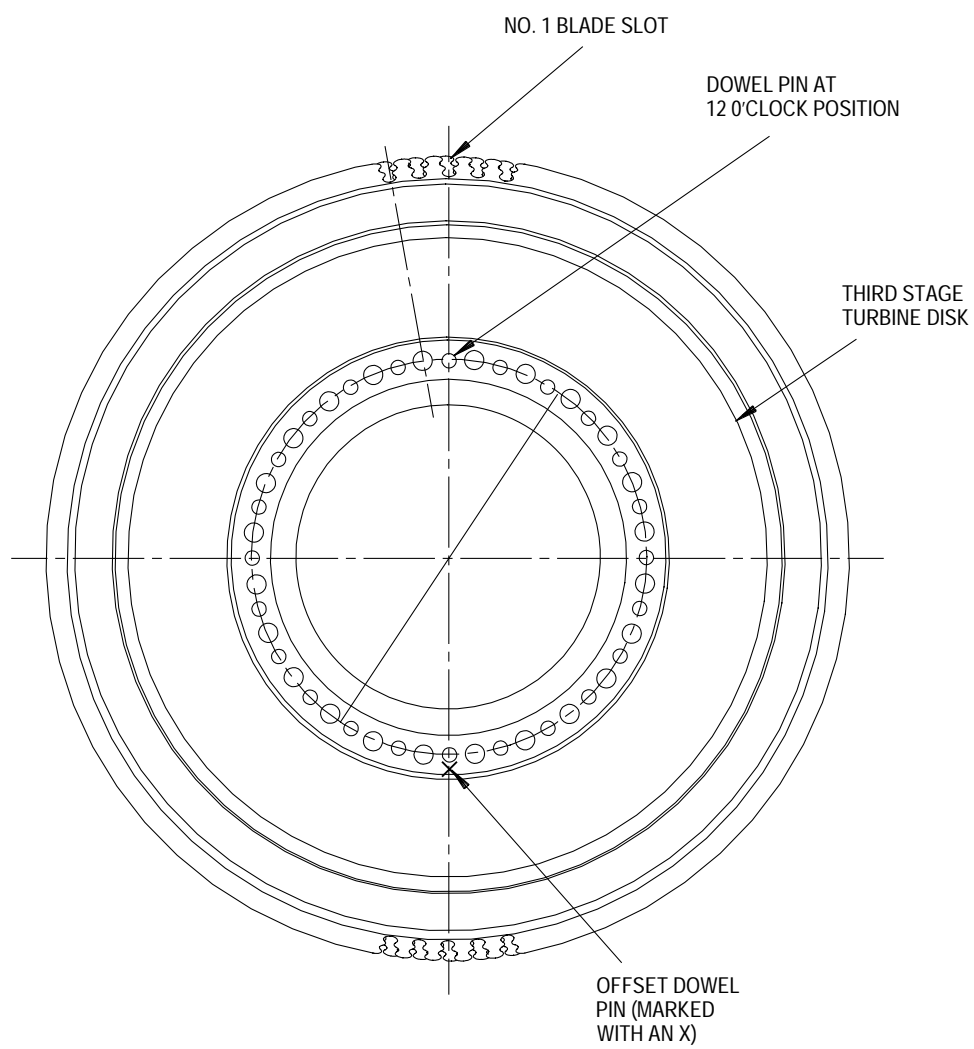
(See Figures 1 and 2.)

NOTE

- Support equipment identified as PWA 57653 detail-X in this WP are details of PWA 57810 tool set.
- When switching blades between modules, take blades from a module which has fewer cycles on it than one in which you are installing blades. For example, it is permissible to install blades from a 700 cycle module into an 800 cycle module. It is not permissible to install blades from an 800 cycle module into a 700 cycle module.
- All turbine blades shall be same part number. Do not mix blades with different part numbers.

- Blades may be replaced in matched moment-weight pairs or in complete sets. When any one blade is replaced, also replace the blade 180 degrees away (opposite).
- A matched moment-weight pair consists of two blades which weigh within 0.200 ounce-inch of each other.
- When replacing a complete blade set, install blades so that all matched pairs are 180 degrees apart.
- Reinstall blades in their original marked locations. (These locations were marked at disassembly.)
- Refer to WP 313 00 for procedure for selecting replacement blades.
- a. Install PWA 57653 detail-5-1 3rd stage pusher/support into PWA 57653 detail-8-1 support assembly. Secure with detail-8-2 quick release pins. Install 3rd stage turbine disk, front face up, on PWA 57653 detail-5-1 3rd stage pusher/support.

- b. Locate No. 1 blade slot.
(See figure 1.)
- c. Install No. 1 blade, blade tang up, about 1/4 of the way down into the No. 1 slot.
(See figure 2.)
- d. Install 2nd through 85th blades in counterclockwise direction:
 - (1) Engage tip shroud of second blade with tip shroud on first blade.
 - (2) Pivot second blade to fit root into disk slot about 1/4 way down.
 - (3) Install 3rd through 85th blades using same procedure.
- e. Install 86th blade by engaging tip shroud with tip shrouds on 1st and 85th blades; then pivot blade to fit root into disk slot.
- f. Seat blades, a little at a time, by tapping them down with a rawhide or fiber mallet. Keep working clockwise around disk until blade tangs are seated against disk. Do not use excessive force to seat blade tangs against disk.



JJ004603 (36X2)

Figure 1. Location of the No. 1 Blade Slot

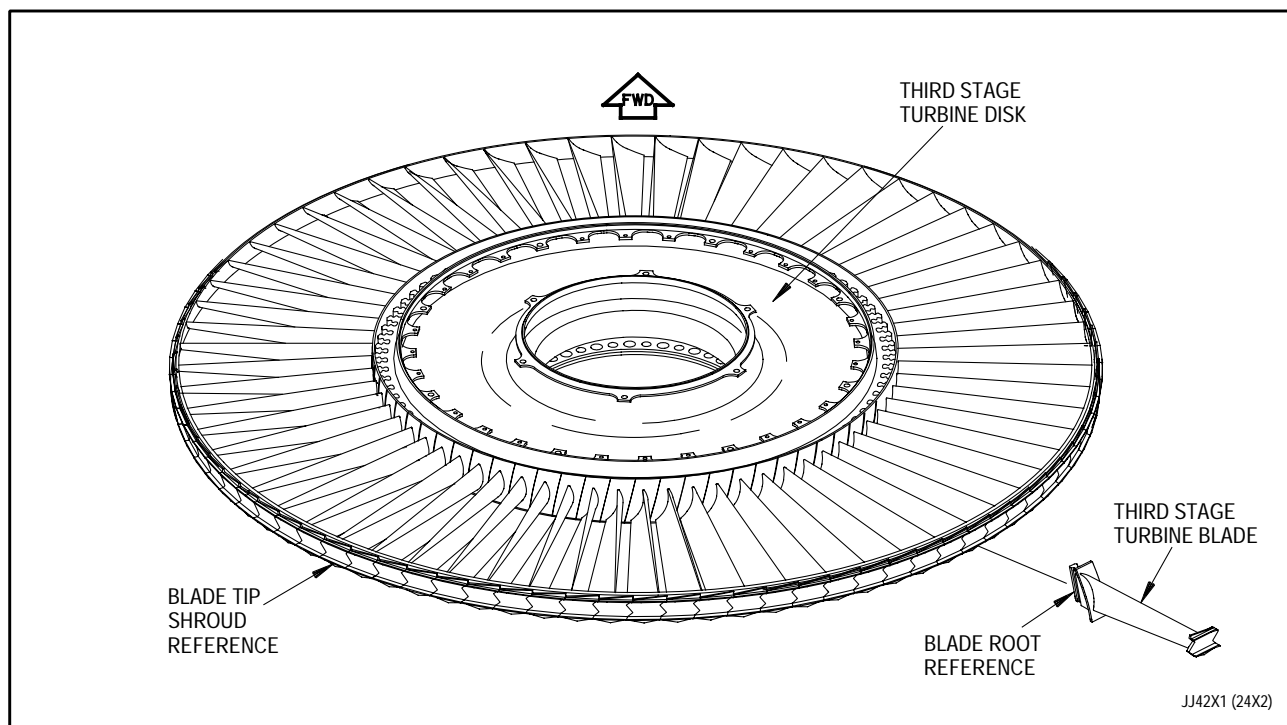


Figure 2. Third Stage Turbine Blades - Installation

3. THIRD STAGE TURBINE AIR SEAL - INSTALLATION.

(See Figure 3.)

- a. Chill air seal(2, figure 3) in freezer.
- b. Remove air seal(2) from freezer and install on 3rd stage turbine disk(3) aligning bolt holes. Hold air seal in place until temperature normalizes.



Failure to install correct attaching hardware will cause engine damage.

NOTE

Two fastener configurations exist. One uses 0.164 inch rivet pins with either collars or self-locking nuts to secure 3rd stage turbine air seal to 3rd stage turbine disk and blades. The other uses 0.190 inch bolts with self-locking nuts.

- c. For 0.190 inch bolt with self-locking nut configuration, secure air seal to 3rd stage turbine disk and blades as follows:
 - (1) Coat threads of bolts(1, figure 3) with MIL-L-7808 lubricating oil and install with heads up (heads shall be forward in assembled engine), through air seal and disk flanges.
 - (2) Install self-locking nuts(4) on bolts(1).



Exceeding torque limits can cause bolt stress or fracture causing severe engine damage.

- (3) Torque bolts, 48 to 50 pound-inches.

NOTE

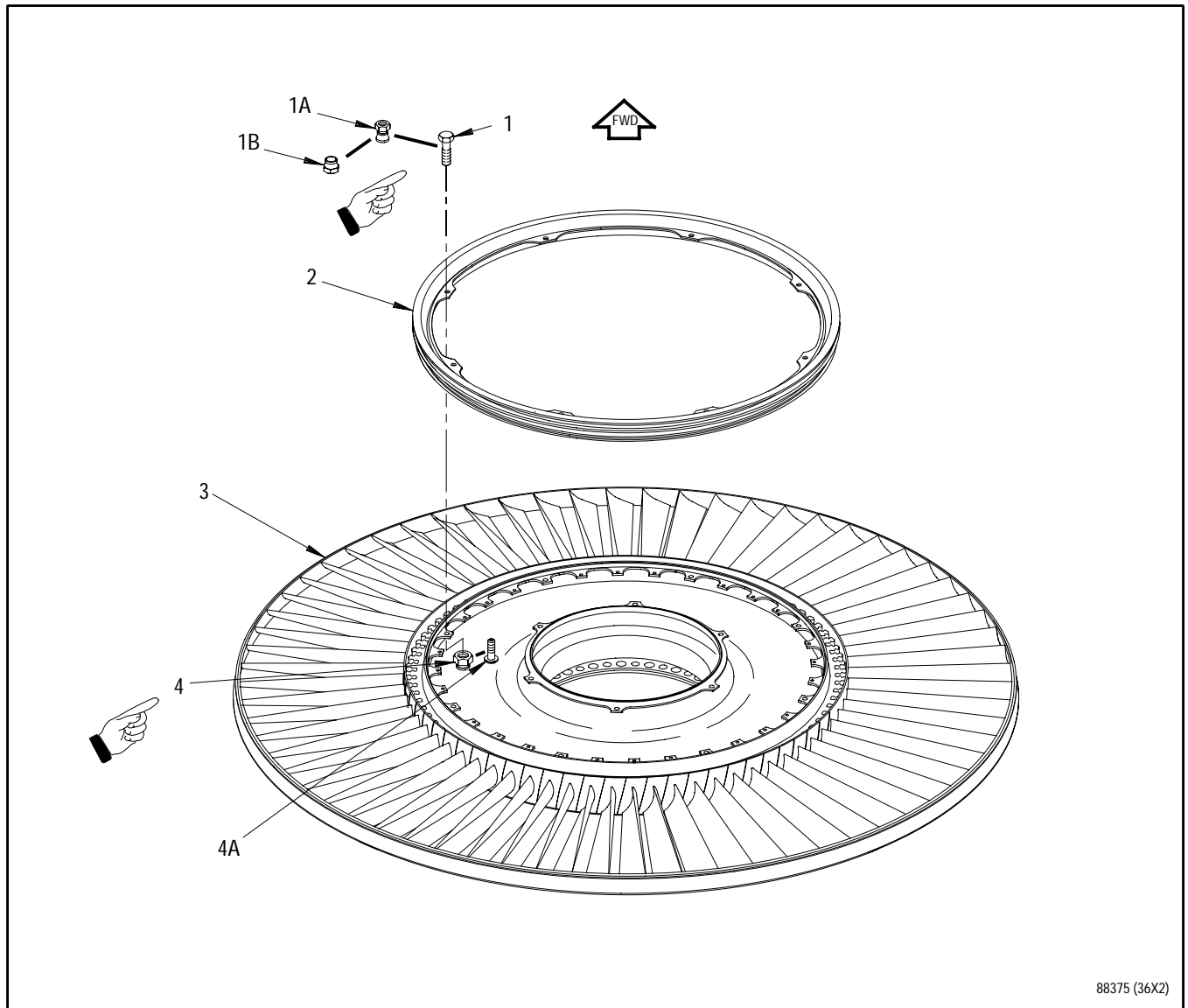
Rivet pins(4A) may be secured using either pre-sheared collars(1A) or self-locking nuts(1B).

- d. For 0.164 inch rivet pin with collar or self-locking nut configuration, secure air seal to 3rd stage turbine disk and blades as follows:
 - (1) Verify correct rivet pins(4A) are used by checking for two wrenching flats on pin heads. If heads do not have wrench flats, replace with proper parts.
 - (2) If using collars(1A), pre-shear heads from collars using standard wrenches on two collar wrench flats.
 - (3) Install rivet pins, heads toward disk, through disk and air seal flanges.
 - (4) Install pre-sheared collars or self-locking nuts(1B) on rivet pins. Verify run-on torque is between 1.5 and 7.0 pound-inches using standard torque wrench on collar or nut while holding rivet pin stationary using flats on rivet pin head. Discard collar or nut if run-on torque is not within 1.5 to 7.0 pound-inch limit.
- e. Check for loose assemblies. Replace if not tight.



Exceeding torque limits can cause rivet pin fracture and severe engine damage.

- (5) Apply final torque 23 to 27 pound-inches to collars or nuts.



88375 (36X2)

- 1. Bolt (0.190 inch)
- 1A. Collar - rivet pin
- 1B. Nut (0.164 inch)
- 2. Third stage turbine air seal
- 3. Third stage turbine disk and blades
- 4. Nut (0.190 inch)
- 4A. Pin - rivet (0.164 inch)

Figure 3. Third Stage Turbine Air Seal - Installation

Figure 4. Deleted.

4. THIRD STAGE TURBINE AIR SEALING RING ASSEMBLY - INSTALLATION.

(See Figure 5.)

- a. If required, heat air sealing ring(1, figure 5) 220° to 230°F (104° to 110°C) for 10 minutes using PWA 56326 heater.
- b. Install air sealing ring(1) on disk(2) aligning match marks and flange holes.



Failure to install correct attaching hardware will cause engine damage.

NOTE

Two fastener configurations exist. One uses 0.164 inch rivet pins with either collars or self-locking nuts to secure 3rd stage air sealing ring to 3rd stage turbine disk and blades. The other uses 0.190 inch bolts with self-locking nuts.

- c. For 0.190 inch bolt with self-locking nut configuration, secure air seal ring to 3rd stage turbine disk and blades as follows:

- (1) Coat threads of bolts(5, figure 5) with MIL-L-7808 lubricating oil and install with heads up (heads shall be forward in assembled engine), through air seal and disk flanges.

- (2) Install self-locking nuts(3) on bolts(5).



Exceeding torque limits can cause bolt stress or fracture causing severe engine damage.

- (3) Torque bolts, 48 to 50 pound-inches.

NOTE

Rivet pins(3A) may be secured using either pre-sheared collars(4) or self-locking nuts(4A).

- d. For 0.164 inch rivet pins with collars or self-locking nut configuration, secure air seal ring to 3rd stage turbine disk and blades as follows:

- (1) Verify correct rivet pins(3A) are used by checking for two wrenching flats on pin heads. If heads do not have wrench flats, replace with proper parts.

- (2) If using collars(4), pre-shear heads from collars using standard wrenches on two collar wrench flats.

- (3) Install rivet pins, heads toward disk, through disk and air sealing ring flanges.

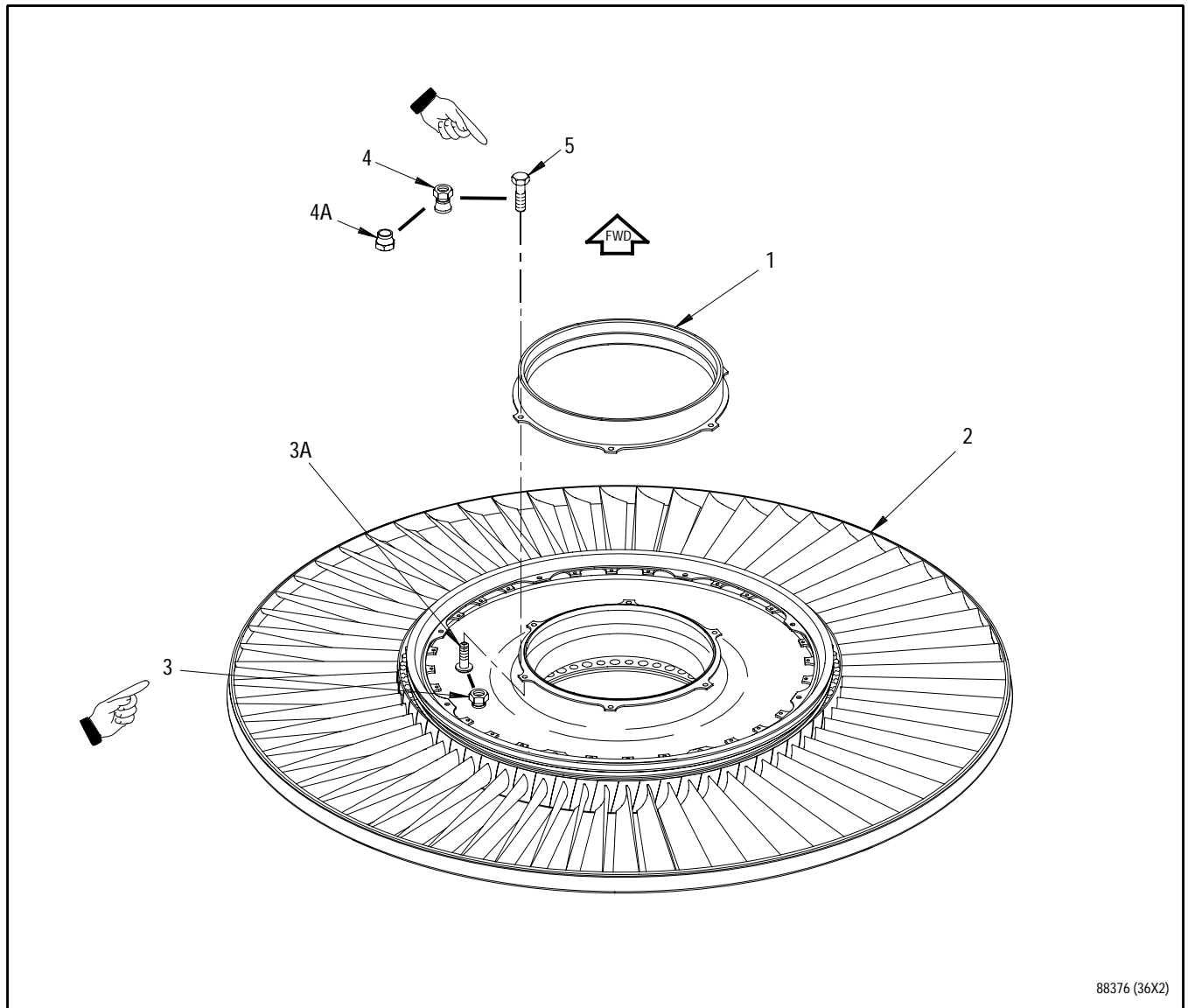
- (4) Install pre-sheared collars or self-locking nuts(4A) on rivet pins. Verify run-on torque is between 1.5 and 7.0 pound-inches using standard torque wrench on collar or nut while holding rivet pin stationary using flats on rivet pin head. Discard collar or nut if run-on torque is not within 1.5 to 7.0 pound-inch limit.



Exceeding torque limits can cause rivet pin fracture and severe engine damage.

- (5) Apply final torque 23 to 27 pound-inches to collars or nuts.

- e. Check for loose assemblies. Replace if not tight.



88376 (36X2)

1. Third stage turbine air sealing ring
2. Third stage turbine disk and blades
3. Nut (0.190 inch)
- 3A. Pin - rivet (0.164 inch)
4. Collar - rivet pin
- 4A. Nut (0.164 inch)
5. Bolt (0.190 inch)

Figure 5. Third Stage Turbine Air Sealing Ring - Installation

5. TURBINE TIERODS - INSTALLATION.

(See Figures 5A and 6.)



Failure to properly coat tierod nuts with antigalling compound may prevent required torque from being achieved.

a. Prepare tierod nuts as follows:

- (1) Ensure tierod nut threads are coated with baked on PWA 36545-3 antigalling compound before installation. Refer to T.O. 2-1-111.
- (2) Prior to reuse only, strip and recoat tierod nut threads with PWA 36545-3 antigalling compound. Nut run on torque shall not exceed five pound-inches.
- (3) If necessary, burnish excess PWA 36545-3 antigalling compound from threads using a medium brass brush. Take care not to expose parent metal.

NOTE


Two methods for turbine tierod installation exist. One uses PWA 57908 support, the other uses PWA 57528 assembly tool (part of PWA 57810 tool set).

b. Install tierods using PWA 57908 support as follows:

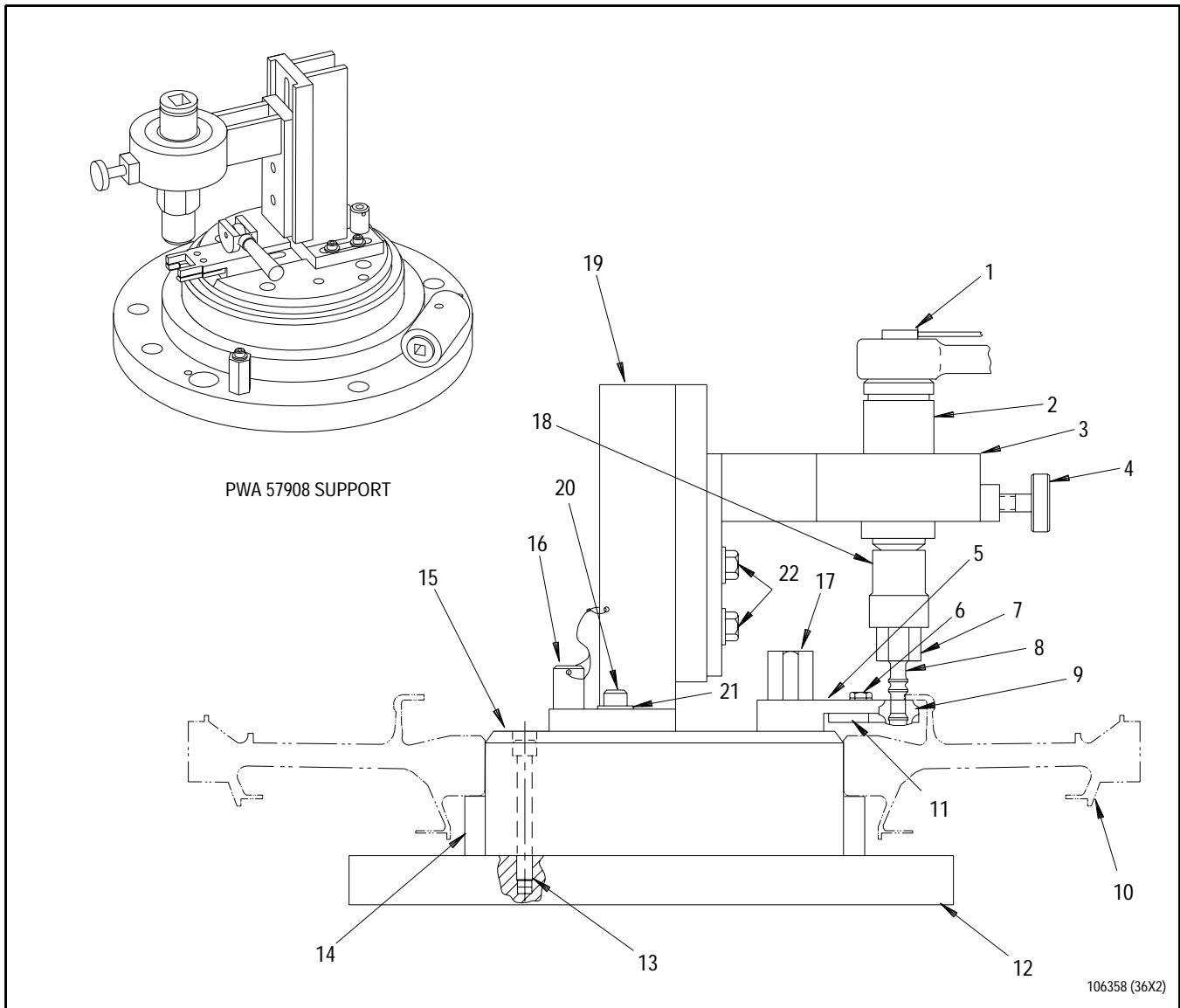
- (1) Place tierod nuts(9) inside disk flange at numbered locations on disk and thread tierods(8) into nuts finger tight.
- (2) Install PWA 53373 clamp on third stage turbine disk and blades.
- (3) Release cam lever(17, figure 5A), block(5), locator(11),

arm assembly(3), and post assembly(19) from PWA 57908 support.

- (4) Secure PWA 57908 base(12) to work surface. Place locating ring(15), chamfered OD up, onto base and secure with socket head cap screws(13).
- (5) Slide support ring(14), chamfered OD up, over locating ring(15) until support ring contacts base.
- (6) Using hoist and PWA 6580 sling attached to PWA 53373 clamp, position 3rd stage turbine disk assembly(10), tierod flange up, on previously installed support ring(14). Remove hoist and PWA 6580 sling.
- (7) Engage flats of block(5) and locator(11) with flats of tierod nut(9).
- (8) Secure block and locator together by tightening hex head screws(6).
- (9) Actuate cam lever(17) to secure block position.
- (10) Install post assembly(19) and arm assembly(3). Align post and arm with locating hole closest to center of base and insert pin assembly(16). Secure using hex head screws(20) and washers(21).
- (11) Loosen thumbscrew(4), and slide block assembly(2) up into arm assembly(3). Secure by tightening thumbscrew(4).

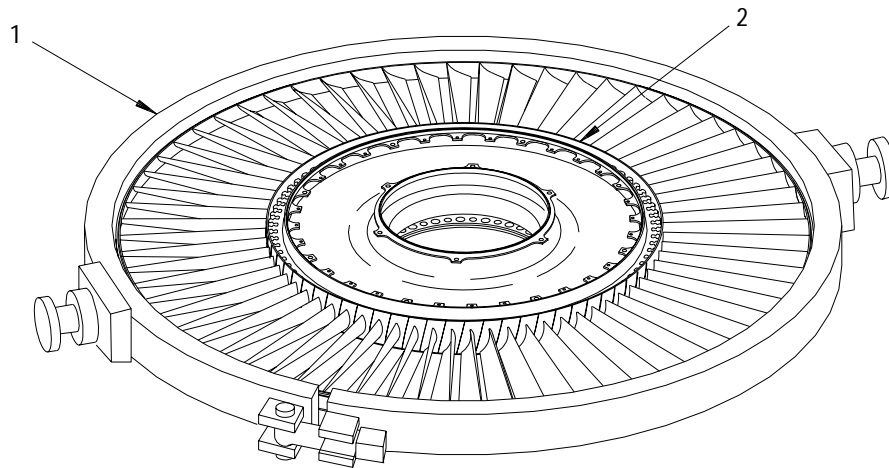
- (12) Install installation adapter(7) on tierod(8).
 - (13) Place socket(18) onto installation adapter(7).
 - (14) Position arm assembly(3) to approximate height necessary to install tierod(8). Secure with hex head screws(22).
 - (15) Loosen thumbscrew(4), and allow block assembly(2) to slide down and engage socket(18).
 - (16) Insert torque wrench(1) into top of block assembly(2).
 - (17) Torque tierod(8) 160 to 170 pound-inches.
 - (18) Loosen tierod to completely relieve torque.
 - (19) Torque tierod(8) 160 to 170 inch-pounds.
 - (20) Remove torque wrench(1), loosen thumbscrew(4), and slide block assembly(2) up into arm assembly(3).
 - (21) Remove socket(18) and installation adapter(7) from tierod(8).
 - (22) Verify minimum tierod length of 0.904 inch. If minimum length is not met, remove tierod per WP 022 00, replace nut and repeat step a., step b.(1), and steps b.(7) through b.(22).
 - (23) Repeat procedure until all tierods have been installed.
 - (24) Remove third stage turbine disk assembly from PWA 57908 support.
 - (24a) With disk lying on padded work bench with tierods facing up, slide PWA 500047 gage over tierod to measure tierod stretch. If gage will not slide onto tierod, tierod is over stretched. Replace tierod.
 - (25) Install packing on each tierod between lands of tierod. See figure 6.
- 

CAUTION
- Do not push packing into disk tierod hole or damage to packing will occur.
- (26) Push tierods down until Surface AG is flush with Surface AH. Do not push packing into disk tierod hole. See figure 6.
 - (27) Locate offset dowel pin hole and mark using Colorbrite No. 2101 silver pencil or equivalent.
 - (28) Apply PWA 36545-3 antigalling compound to third stage disk to hub snap diameter. Remove excess antigalling compound after assembly.
- c. Install turbine tierods using PWA 57528 assembly tool per figure 6.



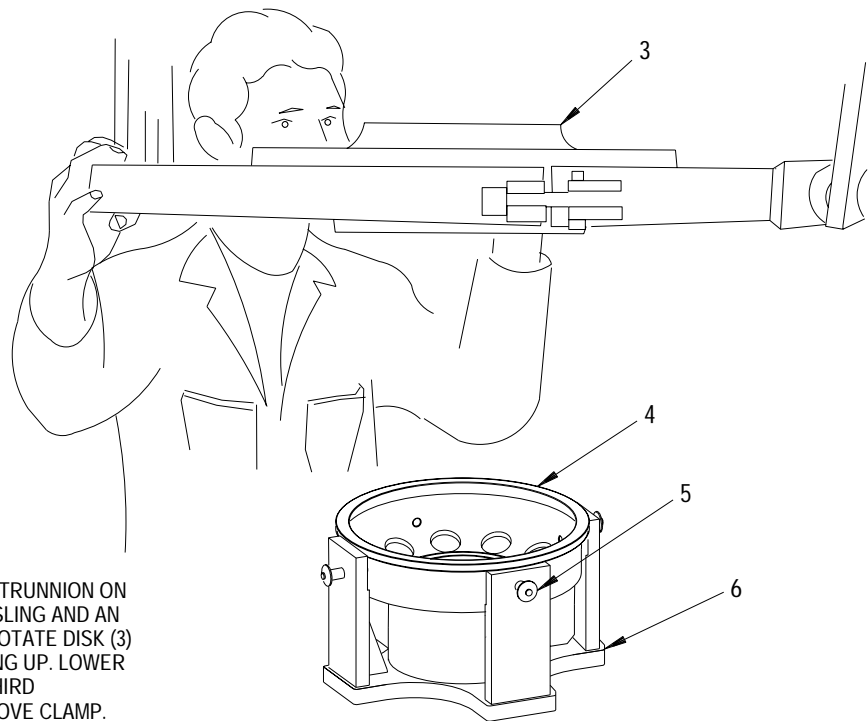
- | | |
|-------------------------------------|---------------------------|
| 1. Torque wrench, 1/2 inch drive | 12. Base |
| 2. Block assembly | 13. Socket head cap screw |
| 3. Arm assembly | 14. Support ring |
| 4. Thumb screw | 15. Locating ring |
| 5. Block | 16. Pin assembly |
| 6. Hex head screw | 17. Cam lever |
| 7. Installation adapter | 18. Socket |
| 8. Turbine tierod | 19. Post assembly |
| 9. Tierod nut | 20. Hex head screw |
| 10. 3rd stage turbine disk assembly | 21. Washer |
| 11. Locator | 22. Hex head screw |

Figure 5A. Turbine Tierods - Installation Using PWA 57908 Support



- a. INSTALL PWA 53373 CLAMP (1) ON THIRD STAGE TURBINE DISK AND BLADES (2).

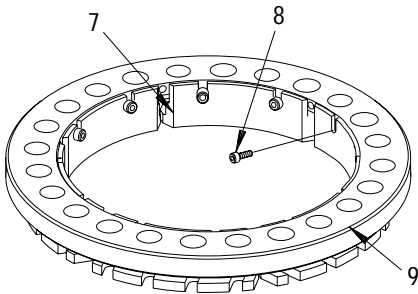
- b. INSTALL PWA 57653 DETAIL-5 THIRD STAGE PUSHER/SUPPORT (4) ONTO PWA 57653 DETAIL-8 SUPPORT ASSEMBLY (6). SECURE WITH DETAIL-8-2 QUICK-RELEASE PINS (5).



- c. ATTACH PWA 26147 ADAPTERS TO TRUNNION ON PWA 53373 CLAMP. USE PWA 6580 SLING AND AN OVERHEAD HOIST TO RAISE AND ROTATE DISK (3) SO THAT TIEROD HOLES ARE FACING UP. LOWER DISK ONTO PWA 57653 DETAIL-5 THIRD STAGE PUSHER/SUPPORT (4). REMOVE CLAMP.

106371 (48X2)

Figure 6. Turbine Tierods - Installation Using PWA 57528 Assembly Tool (Sheet 1 of 3)

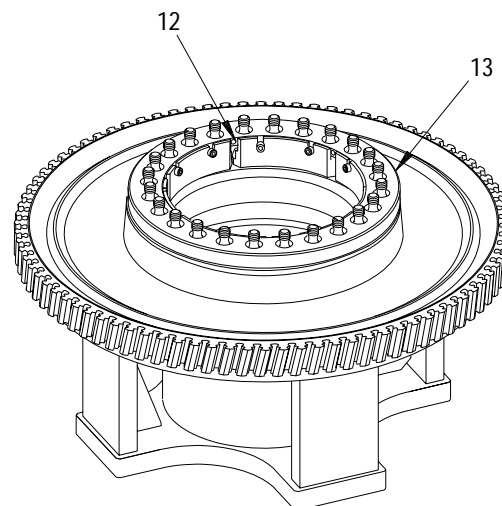
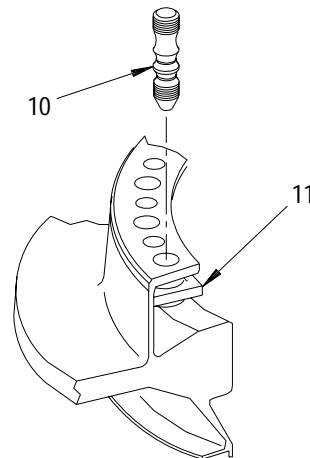


- d. LOOSEN CAP SCREWS (8) AND REMOVE PWA 57528 ASSEMBLY TOOL DETAIL-1 NUT HOLDING SEGMENTS (7) FROM DETAIL-4 BOLT HOLDING RING (9).



IF TIEROD NUT THREADS ARE NOT PROPERLY COATED WITH PWA 36545-3 ANTIGALLING COMPOUND, REQUIRED TORQUE MAY NOT BE REACHED.

- e. ENSURE TIEROD NUT (11) THREADS ARE COATED WITH PWA 36545-3 ANTIGALLING COMPOUND.
- e1. PRIOR TO REUSE ONLY, STRIP AND RECOAT TIEROD NUT THREADS WITH PWA 36545-3 ANTIGALLING COMPOUND. NUT RUN ON TORQUE SHALL NOT EXCEED 5 LB-IN.
- f. IF NECESSARY, BURNISH EXCESS PWA 36545-3 ANTIGALLING COMPOUND FROM TIEROD NUT THREADS USING A MEDIUM BRASS BRUSH. TAKE CARE NOT TO EXPOSE PARENT METAL .
- g. PLACE TIEROD NUTS (11) INSIDE DISK FLANGE AT NUMBERED LOCATIONS ON DISK AND THREAD TIERODS (10) INTO NUTS FINGERTIGHT.
- h. INSTALL DETAIL-1 NUT HOLDING SEGMENTS (12) ON TIEROD NUTS (11).
- i. INSTALL DETAIL-4 BOLT HOLDING RING (13) OVER TIERODS. SECURE SEGMENTS (12) TO BOLT HOLDING RING (13) WITH CAPSCREWS.
- j. TORQUE TIERODS USING STANDARD STUD DRIVER PER STEPS j1 THROUGH j4.



USE CARE NOT TO TOUCH AND DAMAGE INSIDE OF DISK BOLTHOLE DURING TIGHTENING.

- j1. TORQUE TIEROD 160 TO 170 LB-IN., THEN COMPLETELY RELIEVE TORQUE.
- j2. AGAIN TORQUE TIEROD 160 TO 170 LB-IN., AND COMPLETELY RELIEVE TORQUE.
- j3. TORQUE TIEROD 160 TO 170 LB-IN.
- j4. VERIFY TIEROD HEIGHT PER FIGURE 6 (SHEET 3 OF 3). IF MINIMUM HEIGHT IS NOT MET, DISCARD NUT AND REPEAT STEPS (j1) THROUGH (j4).
- j5. REMOVE DETAIL-1 NUT HOLDING SEGMENTS (12) AND DETAIL-4 BOLT HOLDING RING (13).
- j6. WITH DISK LYING ON PADDED WORK BENCH WITH TIERODS FACING UP, SLIDE PWA 500047 GAGE OVER TIEROD TO MEASURE TIEROD STRETCH. IF GAGE WILL NOT SLIDE ONTO TIEROD, TIEROD IS OVER STRETCHED. REPLACE TIEROD.

110543 (48X2)

Figure 6. Turbine Tierods - Installation Using PWA 57528 Assembly Tool (Sheet 2 of 3)

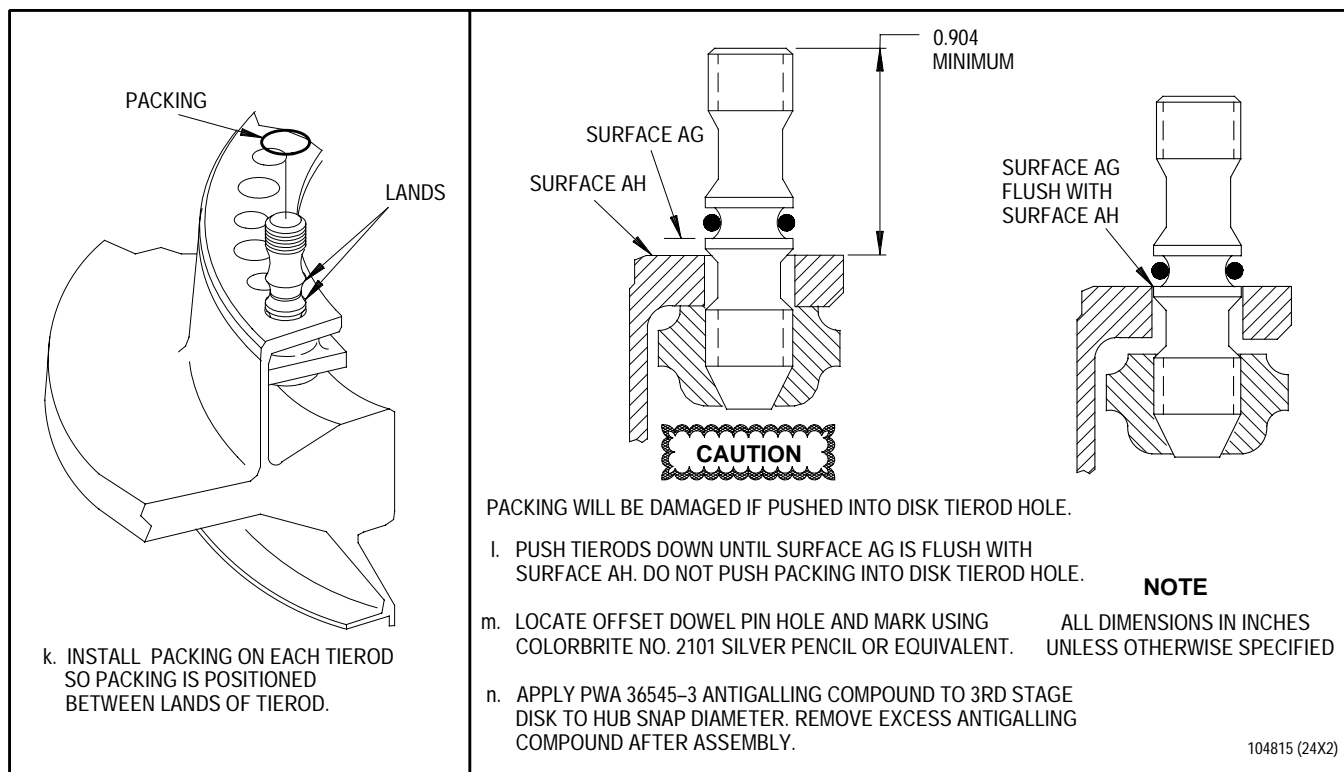
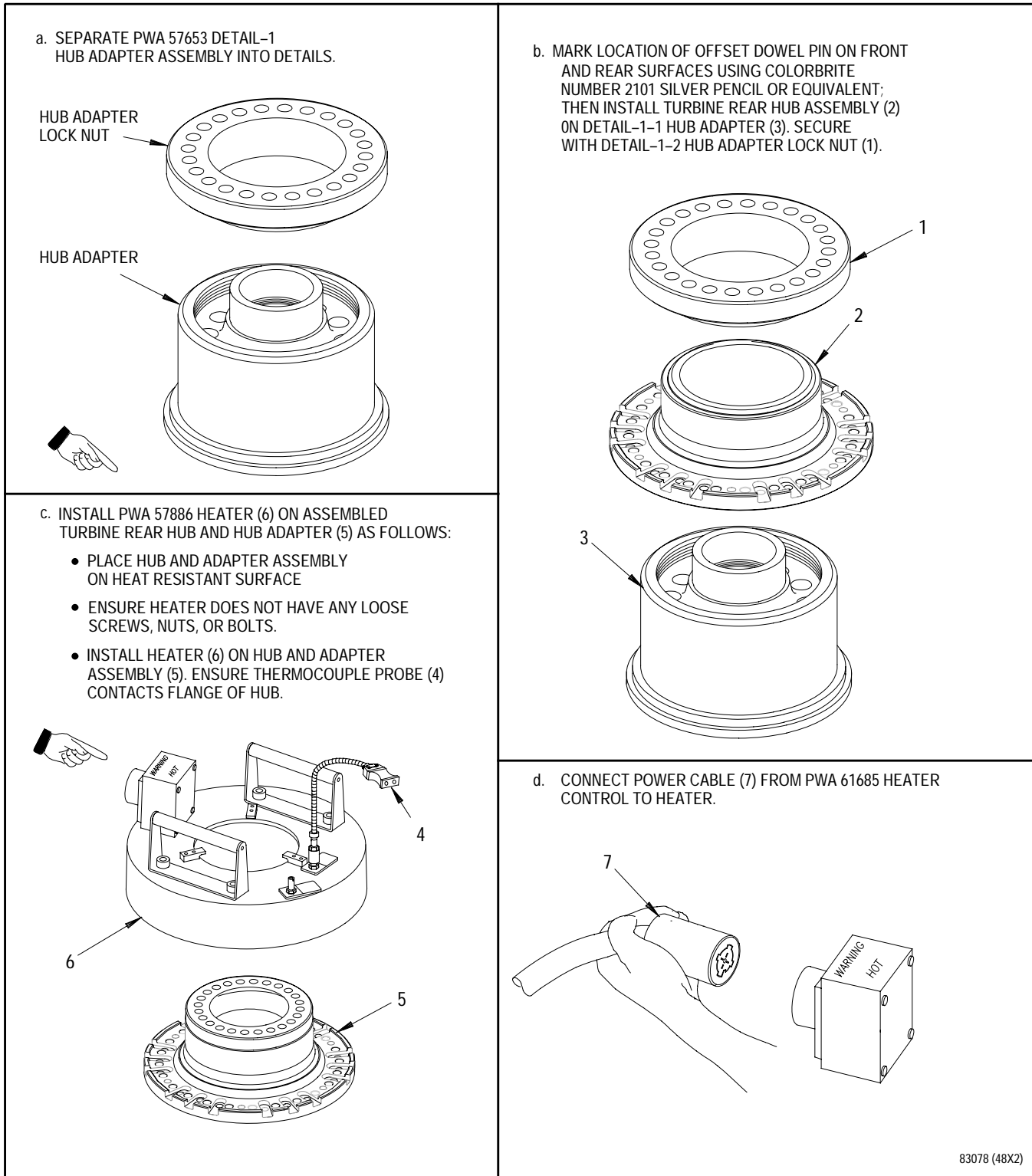


Figure 6. Turbine Tierods - Installation Using PWA 57528 Assembly Tool (Sheet 3 of 3)

6. TURBINE REAR HUB ASSEMBLY - INSTALLATION.

(See Figure 7.)

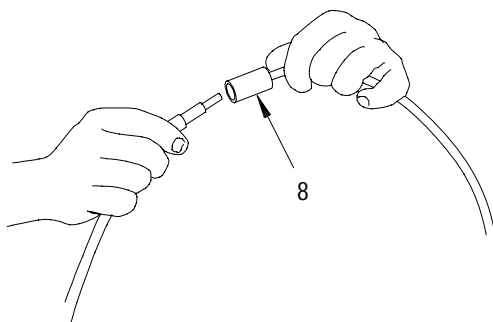
- a. Install turbine rear hub assembly. (See figure 7.)



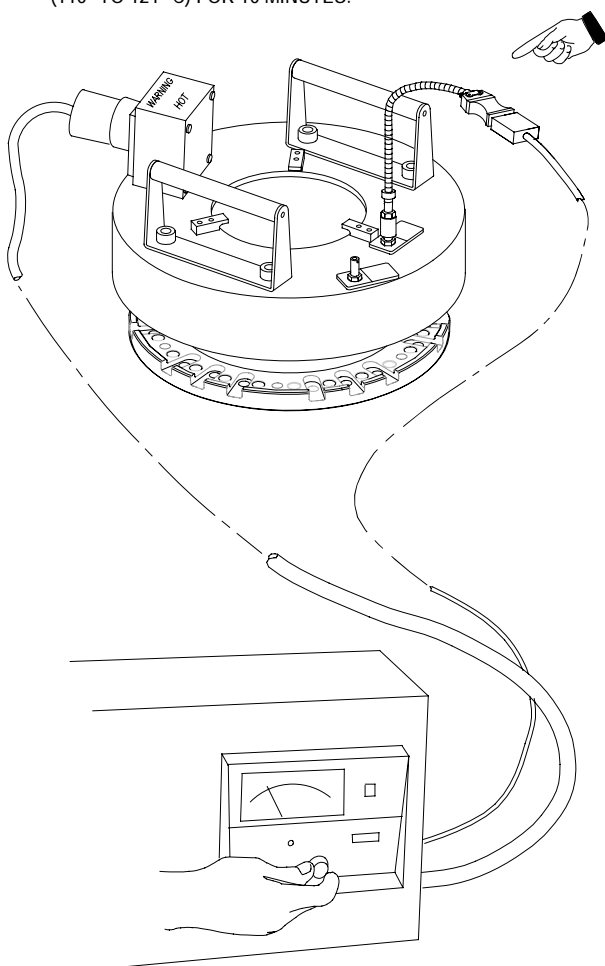
83078 (48X2)

Figure 7. Turbine Rear Hub Assembly - Installation (Sheet 1 of 4)

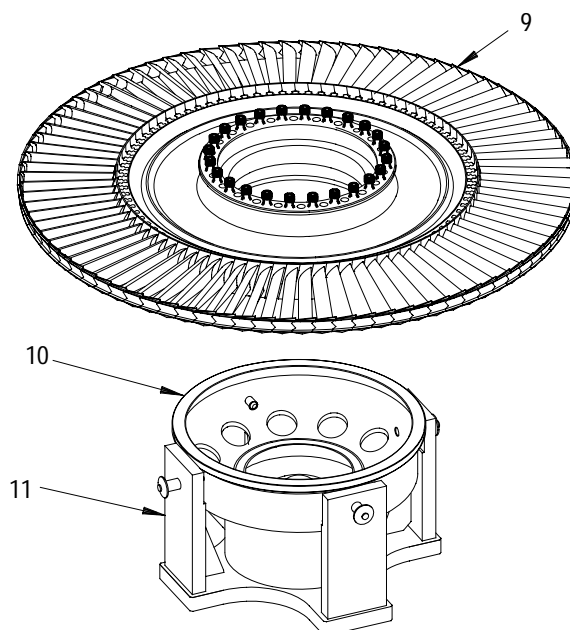
- e. CONNECT THERMOCOUPLE CABLE (8) FROM HEATER CONTROL TO HEATER.



- f. HEAT TURBINE REAR HUB AT 230° TO 250° F (110° TO 121° C) FOR 10 MINUTES.



- g. IF NECESSARY, PLACE 3RD STAGE DISK (9) TIERRODS FACING UP ONTO PWA 57653 DETAIL-5 3RD STAGE PUSHER/PULLER SUPPORT (10) AND PWA 57653 DETAIL-8 SUPPORT ASSEMBLY (11). ENSURE OFFSET DOWEL PIN HOLE IS MARKED USING COLORBRITE NO. 2101 SILVER PENCIL OR EQUIVALENT.

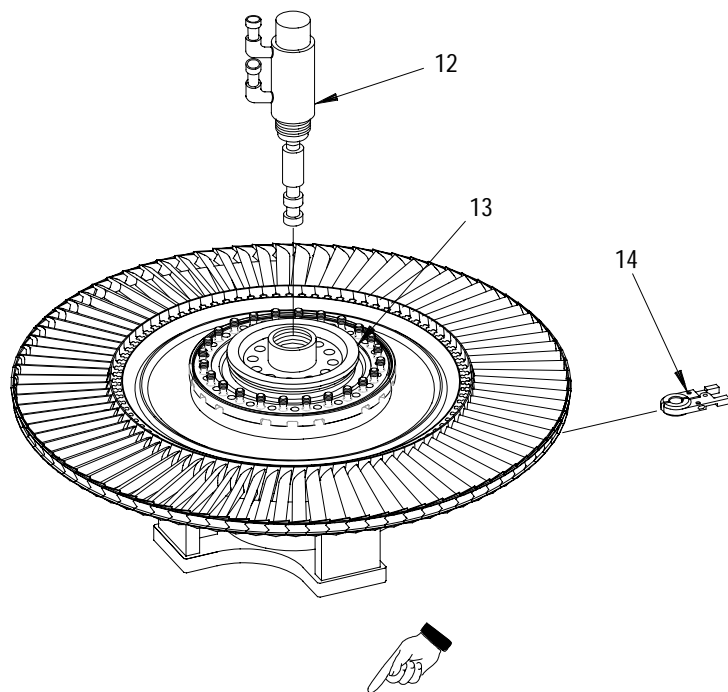
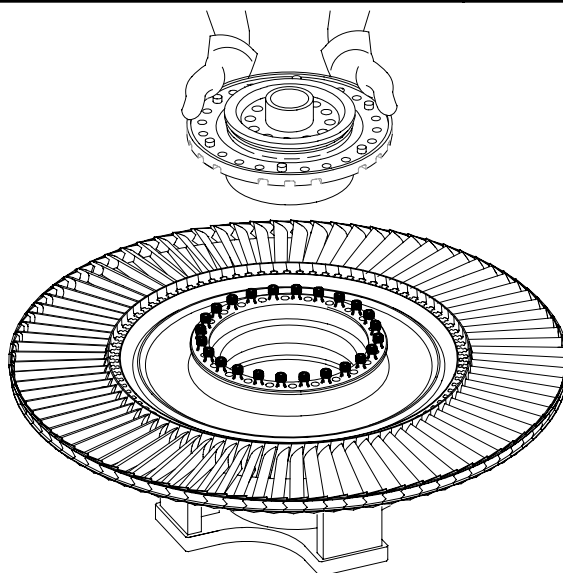


- h. TURN OFF POWER AND REMOVE HEATER FROM TURBINE REAR HUB WHEN TEMPERATURE HAS BEEN REACHED AND TIME HAS ELAPSED.

81876 (48X2)

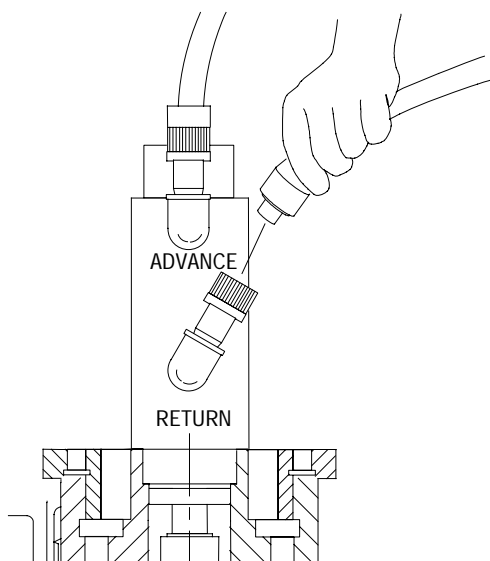
Figure 7. Turbine Rear Hub Assembly - Installation (Sheet 2 of 4)

- i. LOWER HUB FORWARD FACE DOWN
ONTO DISK ALIGNING MATCH MARKS
AND DOWEL PIN HOLES.



- j. INSTALL DETAIL-2 OR DETAIL-17 CYLINDER ASSEMBLY (12) INTO
DETAIL-1 HUB ADAPTER ASSEMBLY (13).

- i. INSTALL DETAIL-3 LOCK ASSEMBLY (14) ON LOWER
GROOVE OF CYLINDER ASSEMBLY (12).



- k. CONNECT HOSES OF PWA 51946 PUMP TO
COUPLERS ON CYLINDER.

NOTE

IT MAY BE NECESSARY TO ACTUATE
PUMP TO ADJUST CYLINDER
ASSEMBLY SHAFT TO INSTALL DETAIL-3
LOCK ASSEMBLY.

66248 (48X2)

Figure 7. Turbine Rear Hub Assembly - Installation (Sheet 3 of 4)

- m. ACTUATE PUMP TO SEAT HUB ONTO DISK.
- n. VISUALLY VERIFY HUB IS SEATED BY VIEWING PARTS THROUGH COOLING AIR PASSAGES ON SIDE OF HUB.
- o. ALLOW HUB TO COOL TO ROOM TEMPERATURE.
- p. DISCONNECT HOSES FROM DETAIL-2 OR DETAIL-17 CYLINDER ASSEMBLY (12).
- q. REMOVE CYLINDER ASSEMBLY (12). DETAIL -1 HUB ADAPTER ASSEMBLY REMAINS ON HUB FOR USE DURING FURTHER INSTALLATION PROCEDURES.



66249 (12X2)

Figure 7. Turbine Rear Hub Assembly - Installation (Sheet 4 of 4)**7. FOLLOW-ON MAINTENANCE.**

- a. Install 3rd stage turbine disk and blades and turbine rear hub assembly per WP 611 00.

WORK PACKAGE

TECHNICAL PROCEDURES

VANES, FOURTH STAGE TURBINE STATOR -
ASSEMBLY TO FOURTH STAGE TURBINE
AIR SEALING RING ASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	29	3 - 4	29	7 Added	28
2	28	5 - 6	28	8 Blank Added	28

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T.O. No.	Date	Level	Title (ECP No.)
2J-F100229(III)-527	15 Jan 1997	D	Installation of Improved Margin Fan Drive Turbine Fasteners, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 95QA087)

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Oil, lubricating	MIL-L-7808

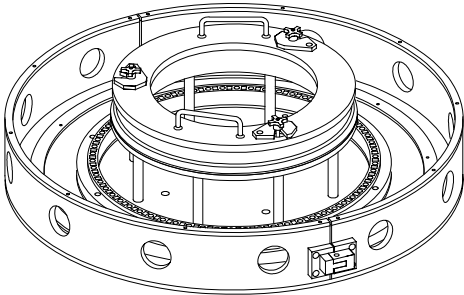
EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Collar - pin, rivet	4061774	56
or	or	
Nut - self-locking, hex	4082753-01	56
Pin - rivet	4074848	56
Bolt	ST2164-020	56

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	Fourth Stage Turbine Stator Vanes - Assembly To Fourth Stage Turbine Air Sealing Ring Assembly. Support, Build - Pin and Collar Installation, 3rd and 4th Stage Turbine Vane, - - - - -	PWA 57913

ILLUSTRATED SUPPORT EQUIPMENT



PWA 57913 -C

Figure T1. PWA 57913 SUPPORT

1. INTRODUCTION.

- a. This work package contains instructions for assembling 4th stage turbine stator vanes to 4th stage turbine air sealing ring assembly.

2. FOURTH STAGE TURBINE STATOR VANES - ASSEMBLY TO FOURTH STAGE TURBINE AIR SEALING RING ASSEMBLY.

(See Figures 1, 1A and 2.)

- a. Arrange vanes(2, figure 1) on bench in order marked at disassembly (leading edge up).



Failure to install 4th stage turbine air sealing ring assembly can cause engine damage.

NOTE

There are two methods to assemble 4th stage turbine air sealing ring assembly.
Method 1, use paragraph a1.
Method 2 use step b. using PWA 57913 support.

- a1. Position 4th stage turbine air seal ring assembly on bench such that, when 4th stage turbine stator vanes are inserted, so that ID platform edges of vanes will lie in same plane as edges of air sealing ring. ID platform leading edge of 4th stage stator vane shall align with forward edge of air seal ring (land with smallest diameter). ID platform trailing edge of 4th stage stator vane shall align with aft edge of 4th stage turbine air sealing ring (land with largest diameter). See figure 1A.
- a2. Verify that edge of 4th stage turbine air seal is not out of alignment with ID platform leading edge of 4th stage stator vane by more than 0.200 inch. See figure 1A, View A.
- b. Install 4th stage turbine air sealing ring as follows:
 - (1) Place PWA 57913 support on suitable bench or tabletop.
 - (a) Loosen hand knobs(1, figure 2) and swing three "C" washers (detail -27) outward to remove ring clamp(2).
 - (2) Install 4th stage turbine air sealing ring with smallest I.D. up on PWA 57913 support.
 - (a) Install ring clamp(2), position three "C" washers (detail -27) and secure hand knobs(1).
- c. For bolt with self-locking nut configuration, secure vanes to air sealing ring as follows:
 - (1) Lubricate threads of 56 bolts(1, figure 1) with MIL-L-7808 engine oil.
 - (2) Position 4th stage turbine stator vanes so that ID platform edges of 4th stage turbine stator vanes lie in same plane as edges of air sealing ring when inserted. Vane ID platform leading edge shall align with forward edge of air sealing ring (land with smallest diameter) and ID platform trailing edge shall align with aft edge of air sealing ring (land with largest diameter). See figure 1A.
 - (3) Verify vane to air sealing ring alignment per View A.

NOTE

Two fastener configurations exist. One uses rivet pins with either collars or self-locking nuts to secure 4th stage turbine stator vanes to 4th stage turbine air sealing ring. The other uses bolts with self-locking nuts.



Improper installation of 4th stage turbine air sealing ring assembly can cause damage to engine.

- (4) Insert sleeve spacer(3, figure 1) in hole in 4th stage vane(2) and slip vane with spacer over one of bolt holes on air seal ring. Ensure outer diameter of vanes rest on split ring(4, figure 2) for correct assembly of vanes and air seal.
- (a) Insert bolt from bottom thru air seal, spacer and secure with self-locking nut(4, figure 1). Verify run-on torque is between 1.5 and 7.0 pound-inches using standard torque wrench on self-locking nut while holding bolt stationary. Discard nut if run-on torque is not within 1.5 to 7.0 pound-inch limit.
- (b) Continue installing vanes with spacers one at a time per step (4) until all but three vanes remain.
- (c) Remove large split ring(4, figure 2) to provide room to install remaining vanes, bolts and nuts.
- (d) Tighten shoulder bolt(detail -10) in center of base to prevent rotation during final torque.
- (5) Apply final torque, 23 to 27 pound-inches, to nuts.

NOTE

Rivet pins(1A) may be secured using either pre-sheared

collars(4A) or self-locking nuts(4).

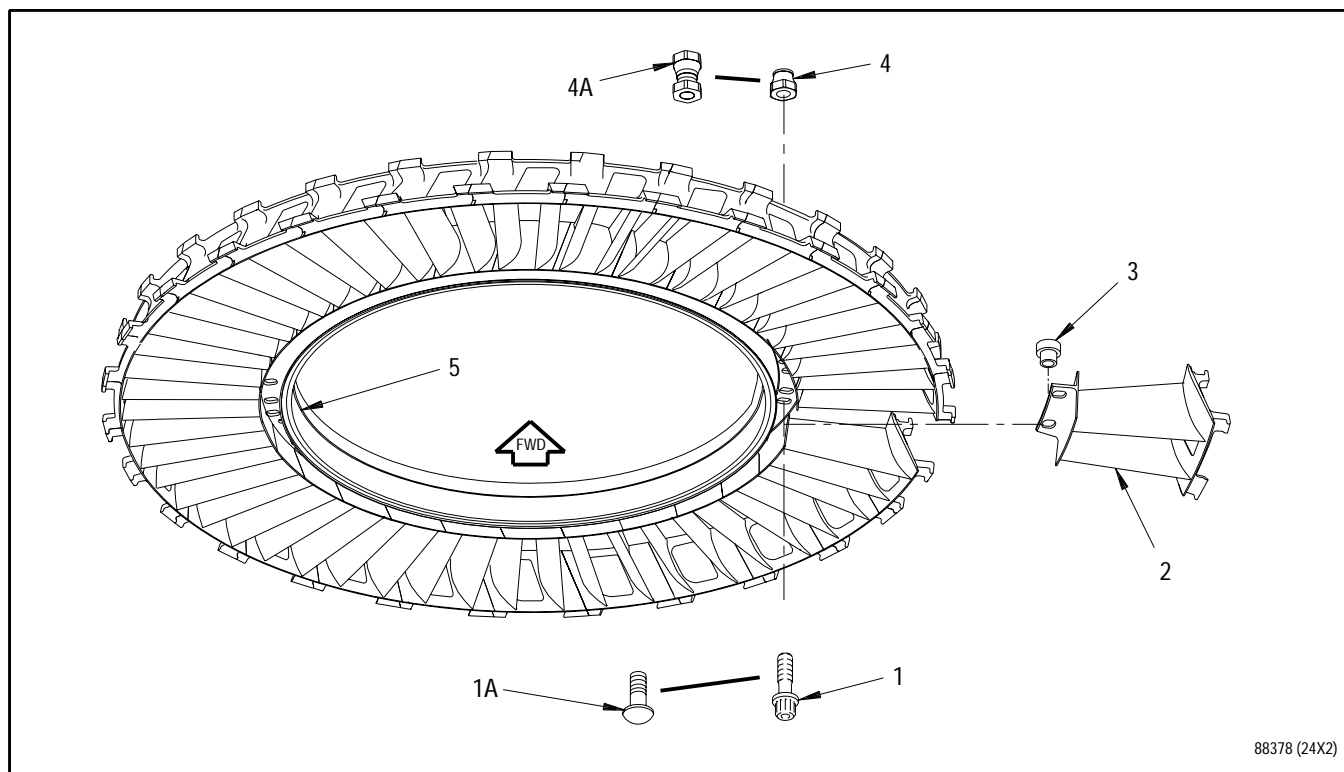
- d. For rivet pin with collar or self-locking nut configuration, secure vanes to air sealing ring as follows:

- (1) Verify correct rivet pins(1A, figure 1) are used by checking for two wrenching flats on pin heads. If heads do not have wrench flats, replace with proper parts.
- (2) If using collars(4A), pre-shear heads from collars using standard wrenches on two collar wrench flats.
- (3) Install vanes on air sealing ring per steps a. thru b.(2) and steps b.(4) and (5).
- (4) Install spacers(3) on rivet pins(1A).
- (5) Install pre-sheared collars(4A) or self-locking nuts(4) on rivet pins. Verify run-on torque is between 1.5 and 7.0 pound-inches using standard torque wrench on collar or nut while holding rivet pin stationary using flats on rivet pin head, or the special D head adapter(detail -28) from PWA 57913 support. Discard collar or nut if run-on torque is not within 1.5 to 7.0 pound-inches limit.



Exceeding torque limits can cause rivet pin fracture and severe engine damage.

- (6) Apply final torque 23 to 27 pound-inches to collars or nuts.
- e. Check for loose assemblies. Replace if not tight.



- 1. Bolt
- 1A. Rivet pins
- 2. Fourth stage turbine stator vanes
- 3. Sleeve spacers
- 4. Nuts
- 4A. Rivet pin collars
- 5. Fourth stage turbine air sealing ring assembly

Figure 1. Fourth Stage Turbine Stator Vanes - Assembly to Fourth Stage Turbine Air Sealing Ring Assembly

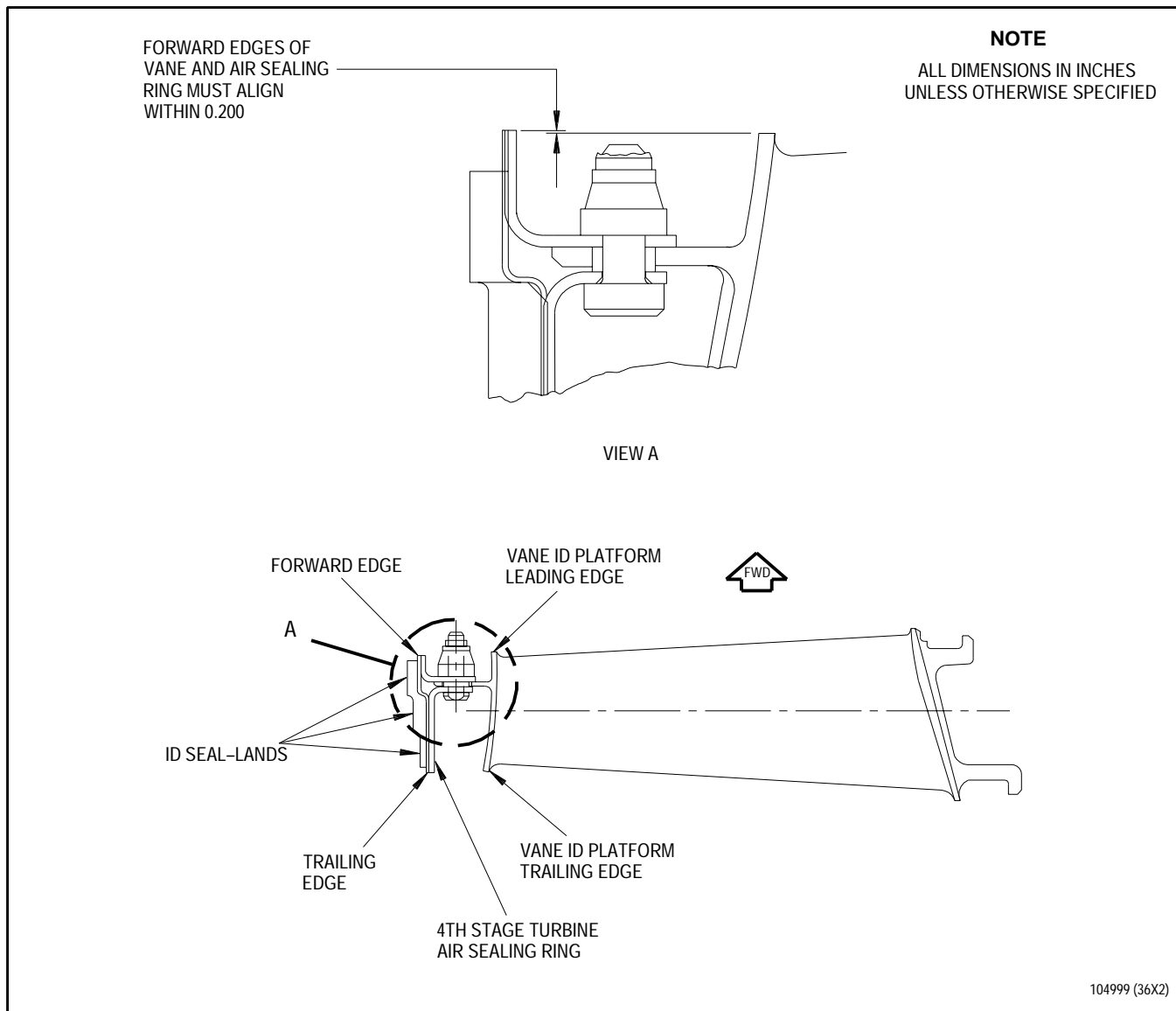
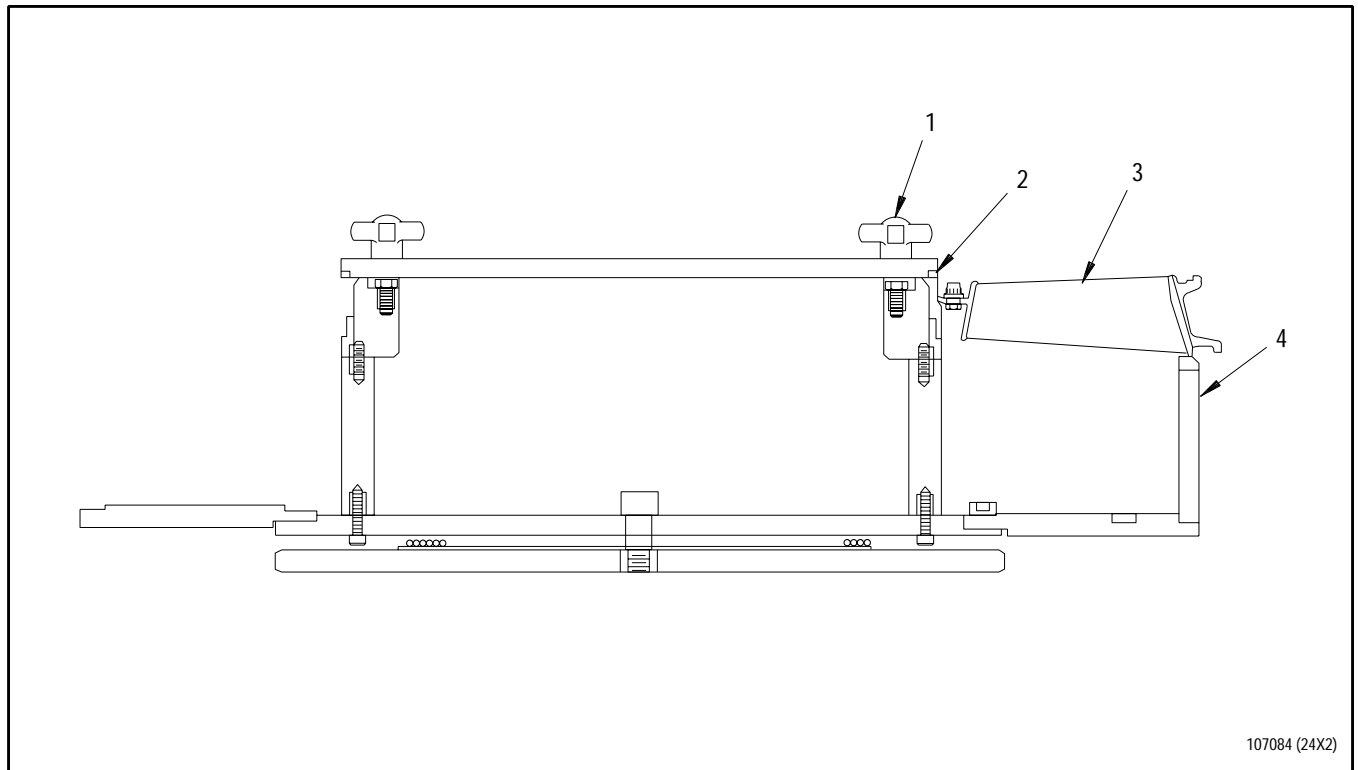


Figure 1A. Fourth Stage Turbine Stator Vanes - Proper Installation of Fourth Stage Turbine Air Sealing Ring Assembly



**Figure 2. Fourth Stage Turbine Stator Vanes -
Installation to Fourth Stage Turbine Air Sealing Ring Assembly
Using PWA 57913 Support**

1. Hand knob, detail -26
2. Ring clamp, detail -22
3. Fourth stage turbine stator vane
4. Split ring, detail -32

3. FOLLOW-ON MAINTENANCE.

- a. Install 4th stage turbine stator assembly per WP 611 00.

WORK PACKAGE

TECHNICAL PROCEDURES

DISK AND BLADES, FOURTH STAGE TURBINE -

ASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	28	2 - 3	13	4 - 6	28

REFERENCE MATERIAL REQUIRED

Title	Number
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Blade, Turbine Rotor, Fourth Stage - Inspection - - - - -	WP 314 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T.O. No.	Date	Level	Title (ECP No.)
2J-F100229-553	15 Feb 1995	O/I	Modification of PWA 57653 tool set, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 94QC004-1)
2J-F100229(III)-517	15 Feb 1995	D	Installation of improved durability 4th stage turbine blade PN 4082504, disk PN 4082604, and air seal PN 4082297, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 93QA253R1C1)
2J-F100229(III)-518	15 Feb 1995	O/I	Installation of improved durability 4th stage turbine blade PN 4082504, disk PN 4082604, and air seal PN 4082297, F100-PW-229 Engines, F-15 Aircraft. (ECP 93QA253R1)

CONSUMABLE MATERIALS

None

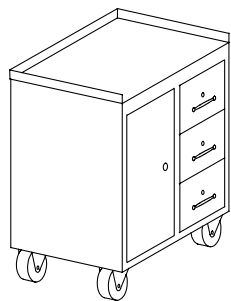
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

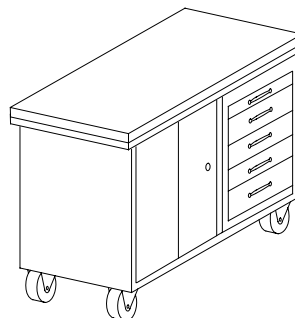
Paragraph	Function - Tool Nomenclature	Tool Number
3	Fourth Stage Turbine Blades - Installation	
	Tool set - fan drive turbine rotor, assembly/disassembly - - - - -	PWA 57810 or PWA 57653

ILLUSTRATED SUPPORT EQUIPMENT



PWA 57653 -C

Figure T1. PWA 57653 Tool Set



PWA 57810 -C

Figure T2. PWA 57810 Tool Set

1. INTRODUCTION.

- a. This work package contains instructions for assembly of 4th stage turbine disk and blades.

2. FOURTH STAGE TURBINE BLADES - INSTALLATION.

(See Figures 1 and 2.)

NOTE

- When switching blades between modules, take blades from a module which has fewer cycles on it than the one in which you are installing blades. For example, it is permissible to install blades from a 700 cycle module into an 800 cycle module. It is not permissible to install blades from an 800 cycle module into a 700 cycle module.
- Blades may be replaced in matched moment-weight pairs or in complete sets. When any one blade is replaced, also replace the blade 180 degrees away (opposite).
- A matched moment-weight pair consists of two blades which weigh within 0.200 ounce-inch of each other.
- When replacing a complete blade set, install blades so that all matched pairs are 180 degrees apart.
- Reinstall blades in their original marked locations. (These locations were marked at disassembly.)
- Refer to WP 314 00 for procedures for selecting replacement blades.

- a. Place 4th stage disk, front face up, in PWA 57653 detail-5 3rd stage pusher/support and detail-8 support assembly (details of PWA 57810 tool set). Secure detail-5 3rd stage pusher/support to detail-8 support assembly with detail-8-2 quick release pins.
- b. Locate No. 1 blade slot. (See figure 1.)
- c. Install No. 1 blade, blade tang up, about 1/4 way down into No. 1 slot. (See figure 2.)

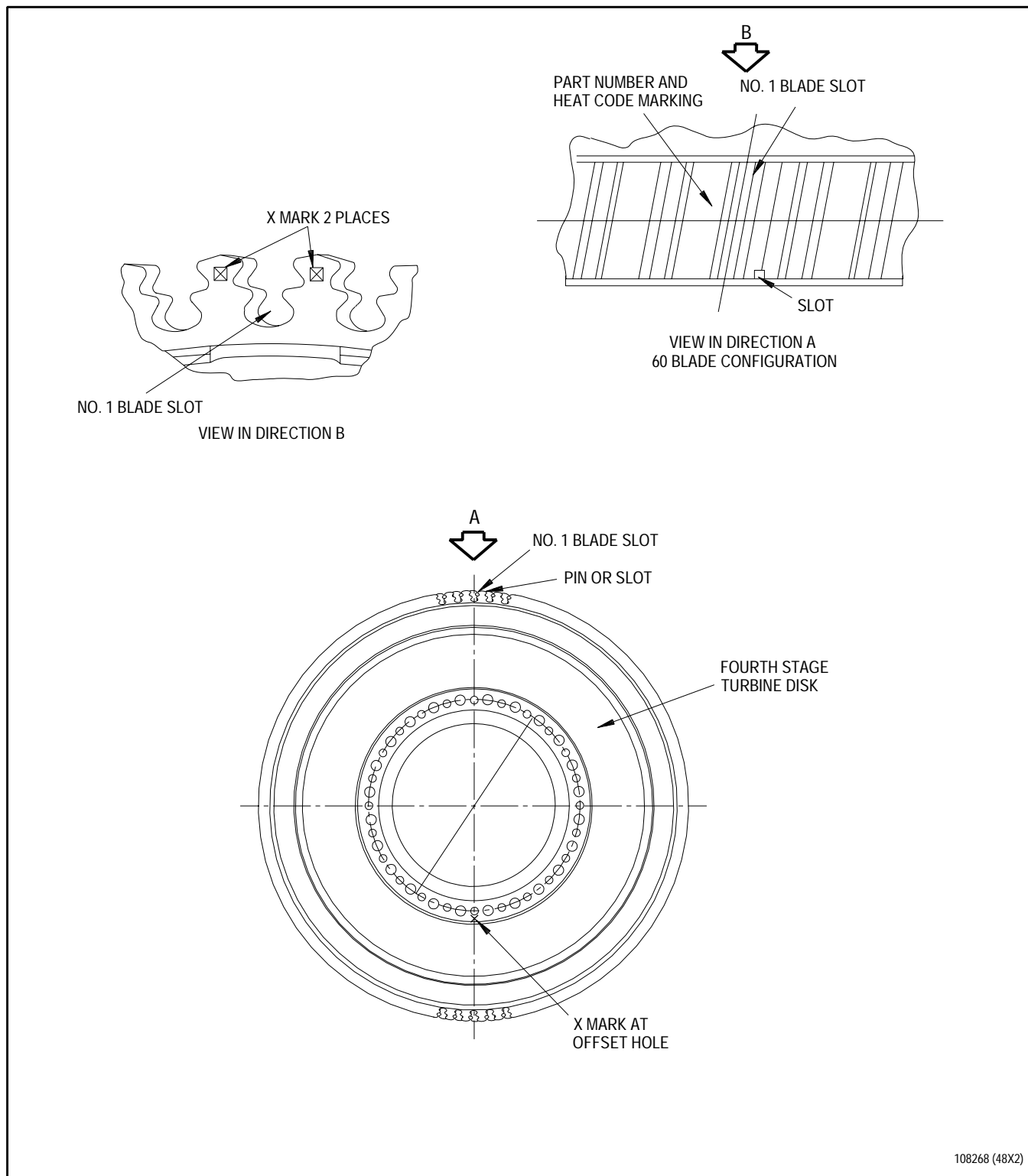


Figure 1. Location of No. 1 Blade Slot

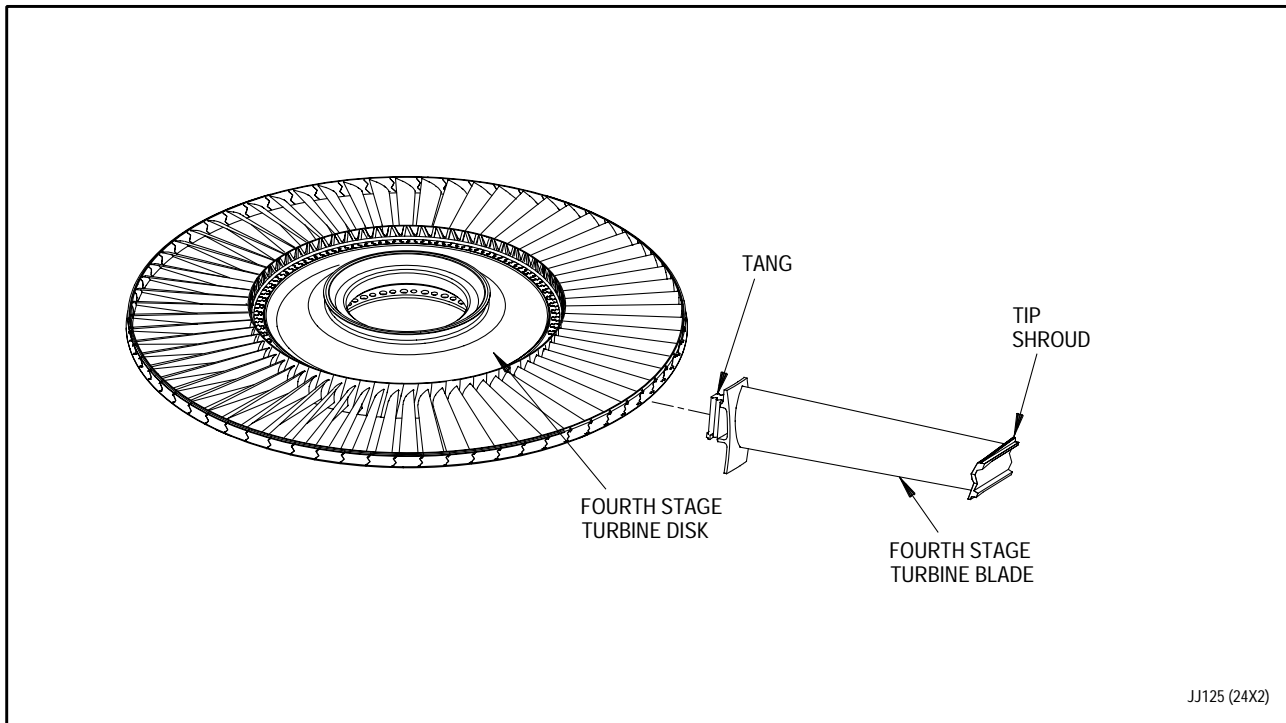


Figure 2. Fourth Stage Turbine Disk and Blades - Assembly

- d. For 60 blade configuration turbine assemblies, install remaining blades as follows:
 - (1) Engage tip shroud of 2nd blade with tip shroud of 1st blade.
 - (2) Pivot 2nd blade to fit root into disk slot about 1/4 way down.
 - (3) Install 3rd through 59th blades using same procedure.
 - (4) Install 60th blade by engaging tip shroud with tip shrouds of 1st and 59th blades; then pivot blade to fit root into disk slot.
- e. Deleted.
- f. Seat blades, a little at a time, by tapping them down with a rawhide or fiber mallet. Keep working clockwise around disk until blade tangs are seated against disk. Do not use excessive force to seat blade tangs against disk.
- g. Secure blades in position using strap or wire.

3. FOLLOW-ON MAINTENANCE.

- a. Install 4th stage turbine disk and blades per WP 611 00.

WORK PACKAGE

TECHNICAL PROCEDURES

SUPPORT ASSEMBLY, NO. 5 BEARING SEAL -

ASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 10

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	17	4	17	4B Blank Added	11
3	4	4A Added	11	5 - 8	17

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Fan Drive Turbine Module - - - - -	T.O. 2J-F100-53-9
Fan Drive Turbine Module - Table of Limits - - - - -	WP 801 00

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
COMPOUND, ANTIGALLING (PWA 36035)	FEL-PRO C-300
FLUID, LEAK CHECK	MIL-L-25567
OIL, LUBRICATING	MIL-L-7808

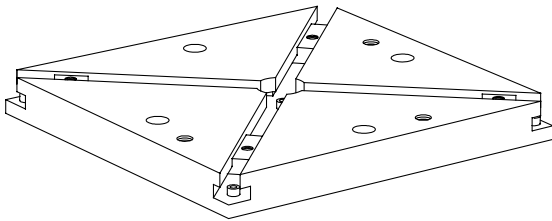
EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
COTTER PIN	MS9245-03	4
LOCKWIRE (0.032 INCH DIAMETER)	MS9226-04	AS REQUIRED
PACKING, PREFORMED	ST2283-014	3
SEAL RING - METAL	4006262	1
SPRING - HELICAL COMPRESSION	4007085	8

APPLICABLE SUPPORT EQUIPMENT

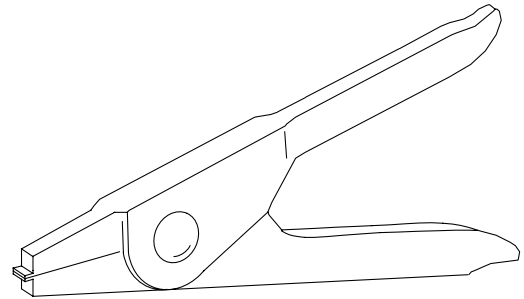
Paragraph	Function - Tool Nomenclature	Tool Number
2	ROD BALL ENDS, BALL SOCKET SEATS, AND OIL CHECK VALVE - INSTALLATION	
	ADAPTER, NO. 5 BEARING SEAL SUPPORT - - - - -	PWA 57760
	ADAPTER, HOLDING - - - - -	PWA 21500
	FIXTURE, LEAK CHECK - - - - -	PWA 57755
3	NO. 5 BEARING FACE SEAL (REAR SEAL) ASSEMBLY - INSTALLATION	
	PLIERS - - - - -	PWA 53778

ILLUSTRATED SUPPORT EQUIPMENT



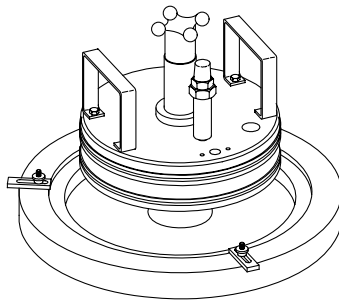
PWA 21500 -C

Figure T1. PWA 21500 ADAPTER



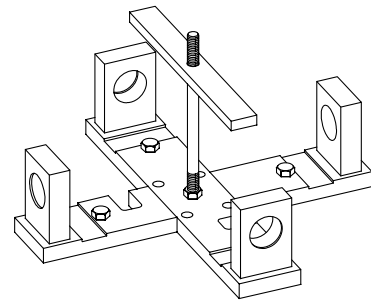
PWA 53778 -C

Figure T2. PWA 53778 PLIERS



PWA 57755 -C

Figure T3. PWA 57755 FIXTURE



PWA 57760 -C

Figure T4. PWA 57760 ADAPTER

1. INTRODUCTION.

- a. This work package contains instructions for assembly of No. 5 bearing seal support.

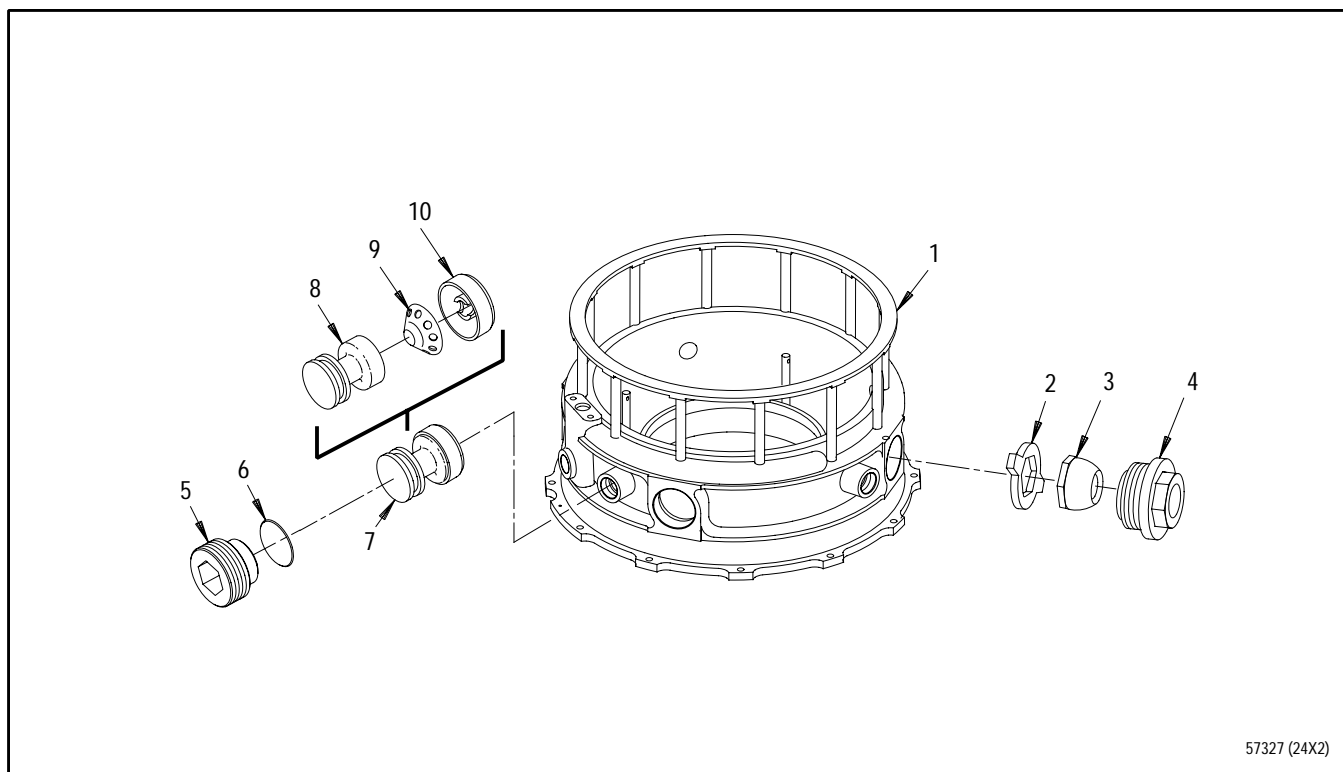
2. ROD BALL ENDS, BALL SOCKET SEATS, AND OIL CHECK VALVE - INSTALLATION.

(See Figures 1, 1A, and 2.)

- a. Install key washers(2, figure 1), rod ball ends(3) and ball socket seats(4) as follows:
 - (1) Insert key washers(2) into four bosses on No. 5 bearing seal support(1). Tabs of key washers fit into slots at each boss.
 - (2) Lubricate threads and spherical inner contact surface of rod ball ends(3) and ball socket seats(4) with Fel-Pro C-300 antigalling compound.
 - (3) Insert hex end of each rod ball end(3) into hex end of each key washer(2) and install ball socket seats(4) at each of four support bosses, fingertight.

- b. Assemble and install three oil check valve assemblies(7) as follows:

- (1) Install oil check valve(9) into oil check valve seat(8) with conical surface of oil check valve seated against concave surface of oil check valve seat.
- (2) Lubricate oil check valve stop(10) with MIL-L-7808 lubricating oil.
- (3) Install oil check valve stop on valve seat and press into place using standard press. Ensure valve stop is fully seated.
- (4) Lubricate packings(6) with MIL-L-7808 lubricating oil. Install packings on oil check valve assemblies(7).
- (5) Insert oil check valve assemblies in oil check valve bosses. Ensure they are seated. Install oil check valve caps(5), fingertight.



57327 (24X2)

1. No. 5 bearing seal support
2. Key washer
3. Rod ball end
4. Ball socket seat
5. Oil check valve cap
6. Packing (PN ST2283-014)
7. Oil check valve assembly
8. Oil check valve seat
9. Oil check valve
10. Oil check valve stop

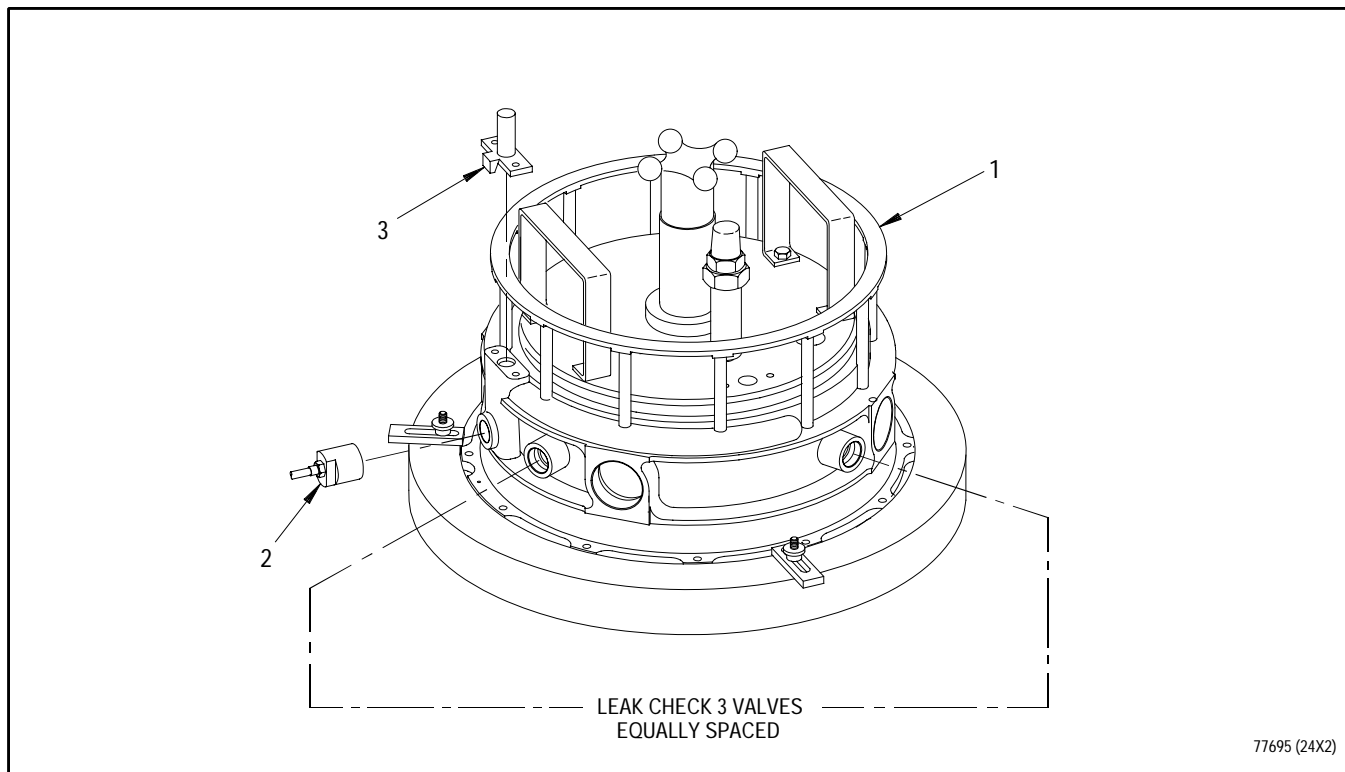
Figure 1. Rod Ball Ends, Ball Socket Seats, and Oil Check Valve - Installation

- c. Install seal support into PWA 57760 adapter:
 - (1) Install PWA 57760 adapter onto PWA 21500 adapter. Secure with cap screws provided.
 - (2) Install No. 5 bearing seal support (heat shield down) aligning dowel pin in support with hole in adapter and position so ball sockets line up with holes on side of PWA 57760 adapter.
 - (3) Secure with metal strap of support between upright rods under top flange and tighten knob.
- d. Torque ball socket seats(4) 2750 to 3000 pound-inches.
- e. Torque oil check valve caps(5) 30 to 50 pound-inches.
- f. Remove seal support from PWA 57760 adapter.
- g. Test oil check valves for leakage using PWA 57755 leak check fixture as follows (see figure 1A):
 - (2) Remove detail O-ring plug and cover from top of cover and bolt to No. 5 bearing seal support oil pressure outlet port.
 - (3) Remove top of fixture and install No. 5 bearing seal support in fixture and secure with clamps.
 - (4) Secure top of fixture in seal support.
 - (5) Pressurize valves during test with nitrogen or air at 75 to 100 psig for one minute.
 - (a) Leak check valves with MIL-L-25567 leak check fluid.
 - (b) Replace any leaking valve details and retest.
 - (6) Remove PWA 57755 fixture and details from No. 5 bearing seal support.
- h. Lockwire socket seats(4, figure 1) with PN MS9226-04 wire. (See figure 2.) Ensure lockwire does not block hole where support rods are installed.
- i. Stake oil check valve caps(5, figure 1) in two places each. Refer to T.O. 2-1-111.

NOTE

Coupling assembly(2), and plug and cover assembly(3) must be removed from storage position in top of fixture and installed directly to No. 5 seal support(1).

- (1) Remove coupling assembly(2) from top of cover and thread securely in No. 5 bearing seal support oil pressure inlet port.



1. No. 5 Bearing seal support
2. Coupling assembly
3. Plug and cover assembly

Figure 1A. No. 5 Bearing Seal Support - Leak Check Using PWA 57755 Fixture

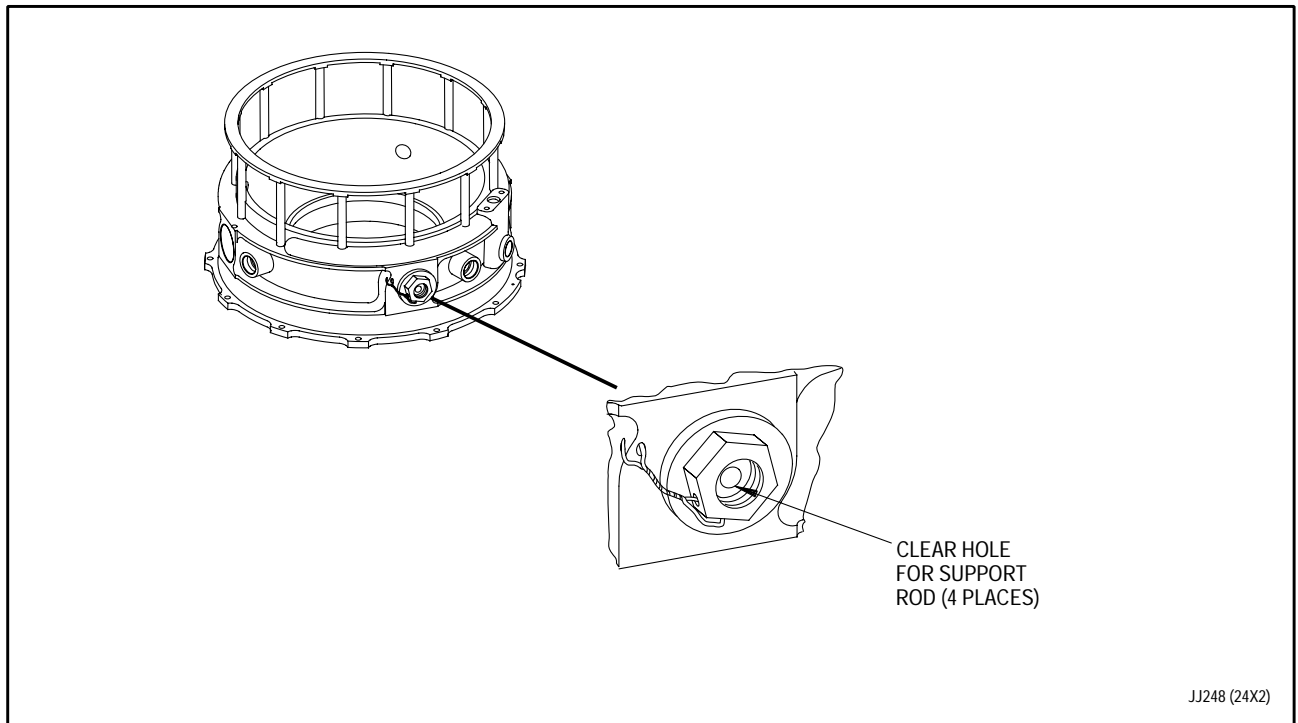


Figure 2. Lockwire Pattern for Ball Socket Seat

3. NO. 5 BEARING FACE SEAL (REAR SEAL) ASSEMBLY - INSTALLATION.

(See Figure 3.)

- a. Install metal seal ring(5, figure 3) as follows:

- (1) Place metal seal ring(5) on bench so part number is up. This is pressure side of ring.
- (2) Insert tip of PWA 53778 pliers into gap of ring(5).



Metal seal ring may be damaged if over expanded.

- (3) Squeeze pliers and expand ring only enough to install over seal support.

- (4) Install ring in groove of seal support(4) so pressure side is up and metal seal ring gap is at 12 o'clock position.

- (5) Check seal ring side clearance. (See figure 3.) Refer to WP 801 00, Reference 4139 for maximum allowable limit.

- b. Install springs(3) on pins in support(4).

- c. Install spring seats(2) into slots on face seal(6).

- d. Install face seal onto seal support(4) so spring seats(2) fit over pins in seal support.

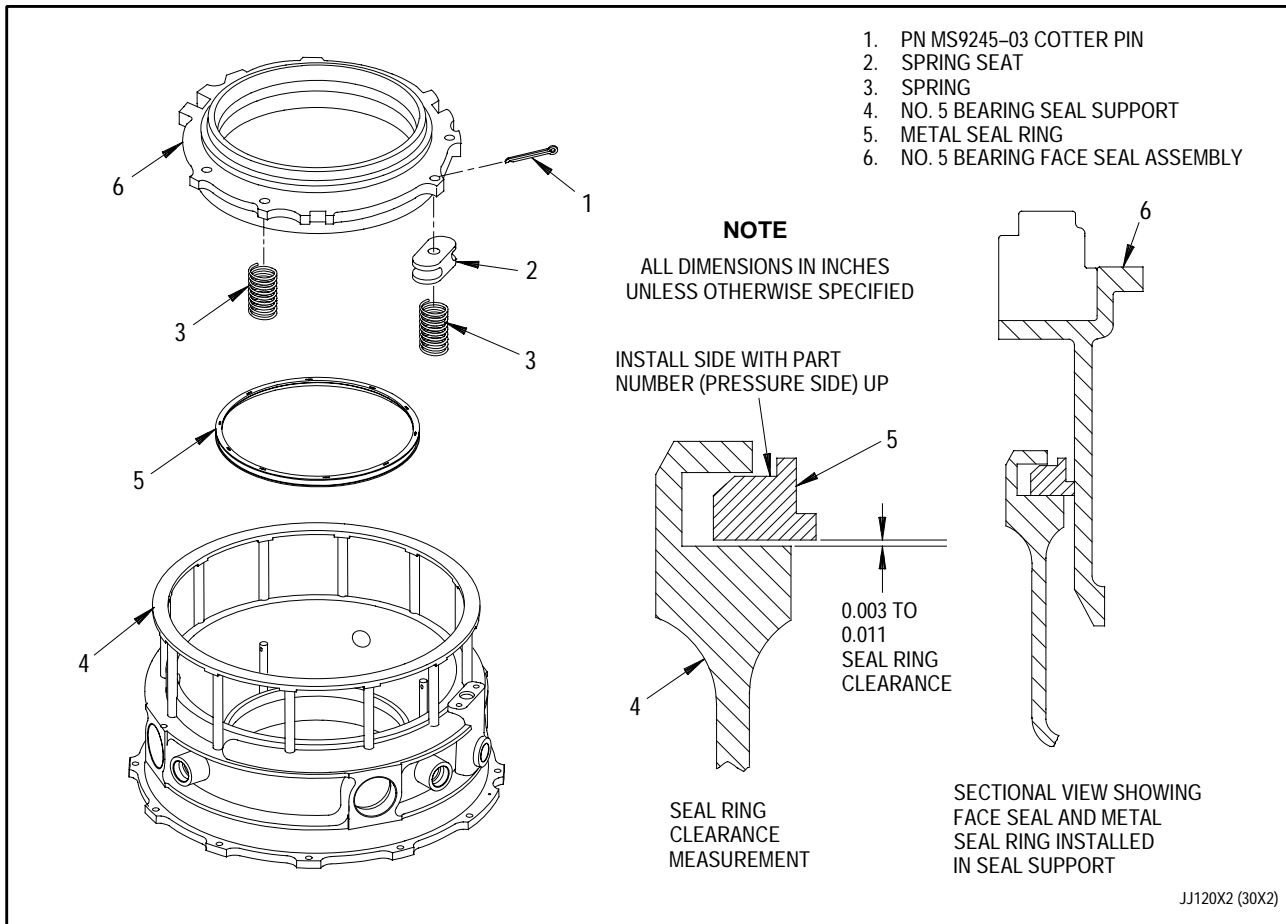


Figure 3. No. 5 Bearing Face Seal (Rear Seal) Assembly - Installation

- e. Depress face seal at each spring location and install cotter pins(1) to secure seal.
- f. Do not fully bend cotter pins(1) at this time. Cotter pins will be bent after seal is airflow checked.
- g. Depress and release the seal several times to ensure it does not stick or hang up.

4. FOLLOW-ON MAINTENANCE.

- a. Perform air leak check of No. 5 bearing face seal per WP 607 00.

WORK PACKAGE

TECHNICAL PROCEDURES

SEAL NO.5 BEARING

AIR LEAK CHECK

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 5	0				
6 Blank	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Oil, lubricating	MIL-L-7808

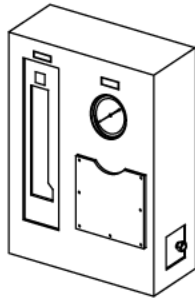
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

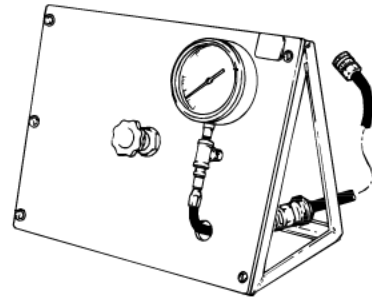
Paragraph	Function - Tool Nomenclature	Tool Number
2	No. 5 Bearing Face Seal Assembly - Leak Check	
	Fixture, Leak check - - - - -	PWA 57610
	Regulator, Air supply - - - - -	PWA 21875
	Flowmeter - - - - -	PWA 6507

ILLUSTRATED SUPPORT EQUIPMENT



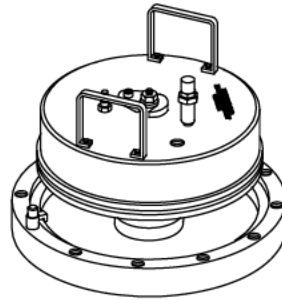
PWA 6507-C

Figure T1. PWA 6507 Flowmeter



PWA 21875 -C

Figure T2. PWA 21875 Regulator



PWA 57610 -C

Figure T3. PWA 57610 Fixture

1. INTRODUCTION.

- a. This work package contains instructions for the leak check of the No. 5 bearing face seal assembly.

2. NO.5 BEARING FACE SEAL ASSEMBLY - LEAK CHECK.

- a. Install assembly in PWA 57610 leak check fixture as follows:
 - (1) Place fixture on bench and remove detail-32 cover.
 - (2) Check condition and cleanness of all gaskets on fixture to ensure proper sealing.
 - (3) Insert detail-11 spacer into detail-32 cover.
 - (4) Place No. 5 bearing seal assembly in fixture with carbon seal up.
 - (5) Secure with detail-8 hook clamp assemblies. Torque to a minimum of 250 pound-inches.
 - (6) Apply list coat of MIL-L-7808 oil to face of carbon seal.

NOTE

Light tapping by soft faced mallet may be required to seat cover assembly.

- (7) Install detail-32 cover assembly on fixture as follows:

- (a) Remove detail-3 nut
- (b) Insert detail-32 cover into No. 5 bearing seal assembly
- (c) Swing detail-25 C-washer on detail-32 cover into position on detail-4 center stud and install detail-3 nut
- (d) Tighten detail-3 nut to secure cover to detail-1 base assembly
- (e) Remove detail-18 pressure relief valve (marked OUTLET) from cover assembly and install in port on No. 5 bearing support.

- b. Connect air supply into PWA 21875 regulator and connect regulator to fitting (stamped INLET) on detail-32 cover.
- c. Connect PWA 6507 flowmeter to fitting (market OUTLET) on No. 5 bearing support.
- d. Apply 30 psig of air pressure to fixture using PWA 21875 regulator. Leakage through PWA 6507 flowmeter shall not exceed 2.8 cfm. If necessary, tap seal assembly lightly to aid in seating seal ring.

- e. If leakage exits, ensure fixture is not leaking before condemning seal assembly.
- f. Turn off air supply, and disconnect INLET and OUTLET connections.
- g. Remove detail-18 pressure relief valve (marked OUTLET) installed in support assembly and secure to detail-32 cover.
- h. Remove detail-32 cover from No. 5 bearing support assembly by removing detail-3 nut, swinging detail-25 C-washer away from detail-4 center stud, and lifting off cover.

- i. Remove seal assembly from fixture and place on clean workbench, carbon seal up.



Be careful when bending cotter pin. Carbon seal is easily damaged.

- j. Bend prongs of cotter pin (previously installed) completely around each side of pin, four places.
- k. Place protective covering onto support to protect carbon seal.

WORK PACKAGE

TECHNICAL PROCEDURES

SEAT, TURBINE SHAFT LOCK -

INSTALLATION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 4

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	30	3	30	4 Blank	0
2	0				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Pencil (crayon), silver,metal marking (hard)	Colorbrite No. 2101, or Color-Tex No. 1843 or Anadel No. 1936

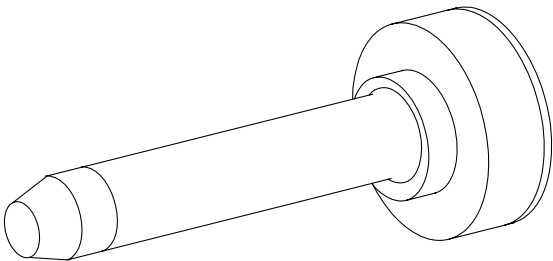
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	Turbine Shaft Lock Seat - Installation	
	Drift, Low turbine coupling lock into shaft -	PWA 51953

ILLUSTRATED SUPPORT EQUIPMENT



PWA 51953 -C

Figure T1. PWA 51953 Drift

1. INTRODUCTION.

- a. This work package contains instructions for installation of the turbine shaft lock seat.

2. TURBINE SHAFT LOCK SEAT - INSTALLATION.

(See Figure 1.)

- a. Chill shaft lock seat in freezer for 20 minutes.

NOTE

Lock seat lug and turbine shaft slot alignment is necessary to ensure alignment of ID splines.

- b. Using Colorbrite No. 2101 silver pencil or equivalent, mark the forward front face of turbine shaft in line with one of four slots on turbine shaft ID.

- c. Ensure front compressor drive turbine shaft spline protector is installed.
- d. Install chilled lock seat onto pilot of PWA 51953 drift.
- e. Align one lug of turbine shaft lock seat with previously marked slot area on turbine shaft.
- f. Tap drift with mallet until lock seat is seated.

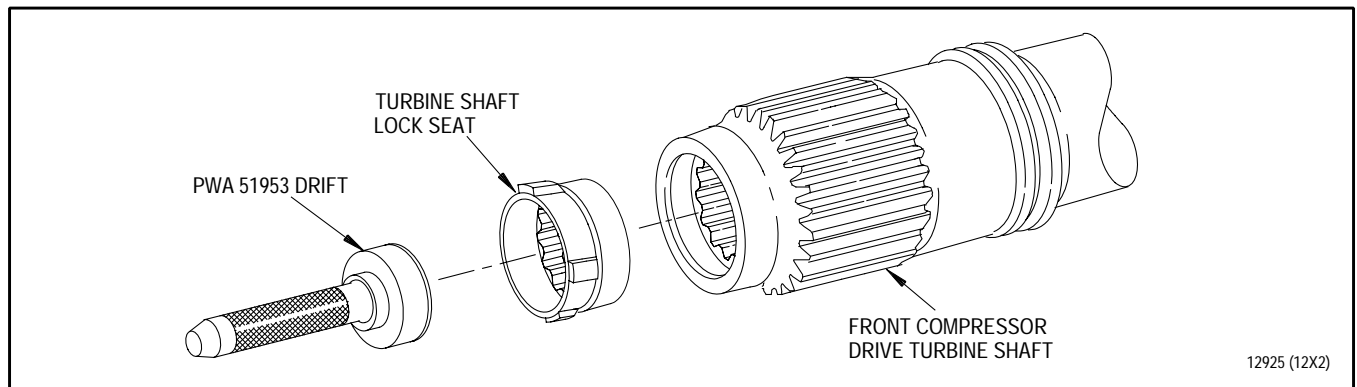


Figure 1. Turbine Shaft Lock Seat - Installation

WORK PACKAGE

TECHNICAL PROCEDURES

CASE ASSEMBLY, TURBINE EXHAUST -

ASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 10

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	30	4A Added	29	6	30
3	20	4B Blank Added	29	7	20
4	30	5	20	8	30

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T.O. No.	Date	Level	Title (ECP No.)
2J-F100229(III)-525	15 Feb 1997	D	Rework of Turbine Exhaust Case and Fourth Turbine Disk; and Installation of New (PN 4082239) Fourth Stage Turbine Brush Seal and Support Assembly, F100-PW-229 Engine, F-15/F-16 Aircraft (ECP 93QA347)

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Oil, lubricating	MIL-L-7808

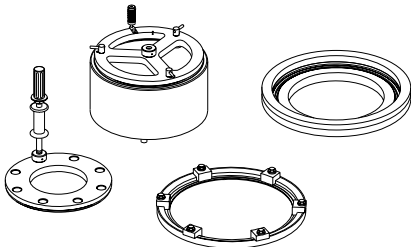
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	FOURTH STAGE TURBINE BRUSH SEAL AND SUPPORT ASSEMBLY AND NO. 5 BEARING SEAL ASSEMBLY - INSTALLATION FIXTURE, BRUSH AND SEAL SUPPORT ASSY 4TH STG TURBINE DISK - - - - -	PWA 57934

ILLUSTRATED SUPPORT EQUIPMENT



PWA 57934 -C

Figure T1. PWA 57934 PWA 57934

1. INTRODUCTION.

- a. This work package contains instructions for turbine exhaust case assembly using the following parts:
 - Fourth stage turbine brush seal and support assembly
 - Fourth stage turbine air sealing ring assembly
 - No. 5 bearing seal assembly
 - Front and rear turbine exhaust duct assemblies
- b. For turbine exhaust case assemblies incorporating a 4th stage turbine brush seal and support assembly, refer to paragraph 2. For turbine exhaust case assemblies incorporating a 4th stage turbine air sealing ring assembly, refer to paragraph 3.

2. FOURTH STAGE TURBINE BRUSH SEAL AND SUPPORT ASSEMBLY AND NO. 5 BEARING SEAL ASSEMBLY - INSTALLATION.

(See Figures 1 and 2.)

NOTE

There are two methods to assemble 4th stage turbine brush seal and support assembly.

Method 1, use steps a. through k.

Method 2, use step l. using PWA 57934 fixture.

- a. Position case assembly(5, figure 1) flat on bench so both forward and aft flanges are accessible.
- b. Lubricate threads of bolts(1) with MIL-L-7808 oil.
- c. Install spacer(2) heat shields(3) aligning ends of heat shields at 3 o'clock and 9 o'clock positions onto No. 5 bearing seal assembly(4) with bolts(1) installed.
- d. Ensure gaps between spacers(2) do not overlap gaps between heat shields(3).

NOTE

No. 5 bearing pressure tube is located at 12 o'clock position, 180 degrees from dowel pin hole in outer flange.

- e. Install as a unit into turbine exhaust case(5) aligning dowel pin in seal assembly(4) with dowel pin hole in case.
- f. Ensure holes in heat shield align with support rod bosses.
- g. Chill 4th stage turbine brush seal and support assembly(6) in freezer for 20 minutes.



Failure to install 4th stage turbine brush seal and support assembly properly can cause engine damage.

- h. Remove 4th stage turbine brush seal and support assembly(6) from freezer and position on front side of case, aligning bolt holes. Hold in place until temperature normalizes. Ensure that 4th stage turbine brush seal and support assembly is installed properly. (See figure 2.)
- i. Secure 4th stage turbine brush seal and support assembly(6, figure 1) and No. 5 bearing seal assembly(4) with bolts(1).
- j. Visually verify that support rod and oil tube passages in turbine exhaust case assembly align with No. 5 bearing seal assembly.
- k. Seat No. 5 bearing seal assembly(4) into case assembly(5) by tightening bolts in pairs 180 degrees apart. Apply final torque of 27 to 30 pound-inches to bolts.

1. Install 4th stage turbine brush seal and support assembly using PWA 57934 fixture as follows:
 - (1) Place PWA 57934 fixture detail -12 and -18 on work bench with reset buttons down.
 - (2) Install turbine exhaust case onto detail -12 rear end down until inside diameter flange contacts and rests on top surface of detail -12.
 - (3) Install guide plate detail - 12 onto brush seal and support with brush seal on top and lock plate to seal assembly using cam locks. Ensure offset hole is aligned and pinned to guide hole on guide plate.
 - (4) Depending on tight fit condition, guide plate and brush seal assembly may be installed without chilling. Tight fit of interfacing diameters can vary from 0.002 to 0.012 inches tight.
 - (5) Install guide plate and brush seal assembly using tool without chilling for first try to install. If difficulty is encountered, chill with dry ice or equivalent for 15 minutes minimum or freezer chill minimum of 30 minutes.
 - (6) Install chilled guide plate and brush seal assembly onto turbine exhaust case inside diameter and using slide hammer drift into place into plate.
 - (7) Remove guide plate from brush and support assembly.
 - (8) Install engine bolts through turbine exhaust case flange to final seat brush and support assembly within 5 minutes of initial installation to prevent support assembly from popping out of exhaust case.
 - (9) Remove tooling.
 - (10) Complete installation per steps i. through k.

Legend for figure 1

1. Bolts
2. Spacers
3. Heatshields
4. No. 5 Bearing Seal Assembly
5. Turbine Exhaust Case Assembly
6. 4th Stage Turbine Brush Seal and Support Assembly

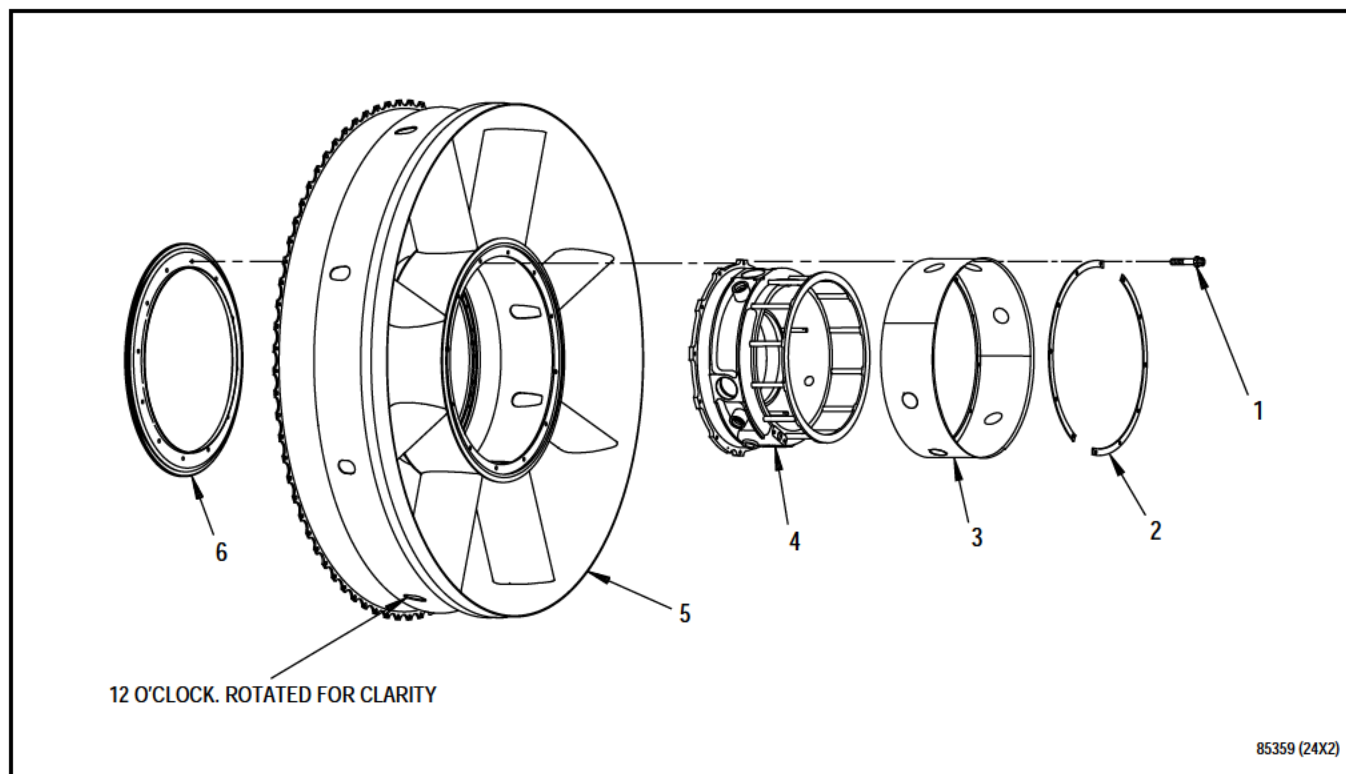


Figure 1. Fourth Stage Turbine Brush Seal and Support Assembly and No. 5 Bearing Seal Assembly - Installation

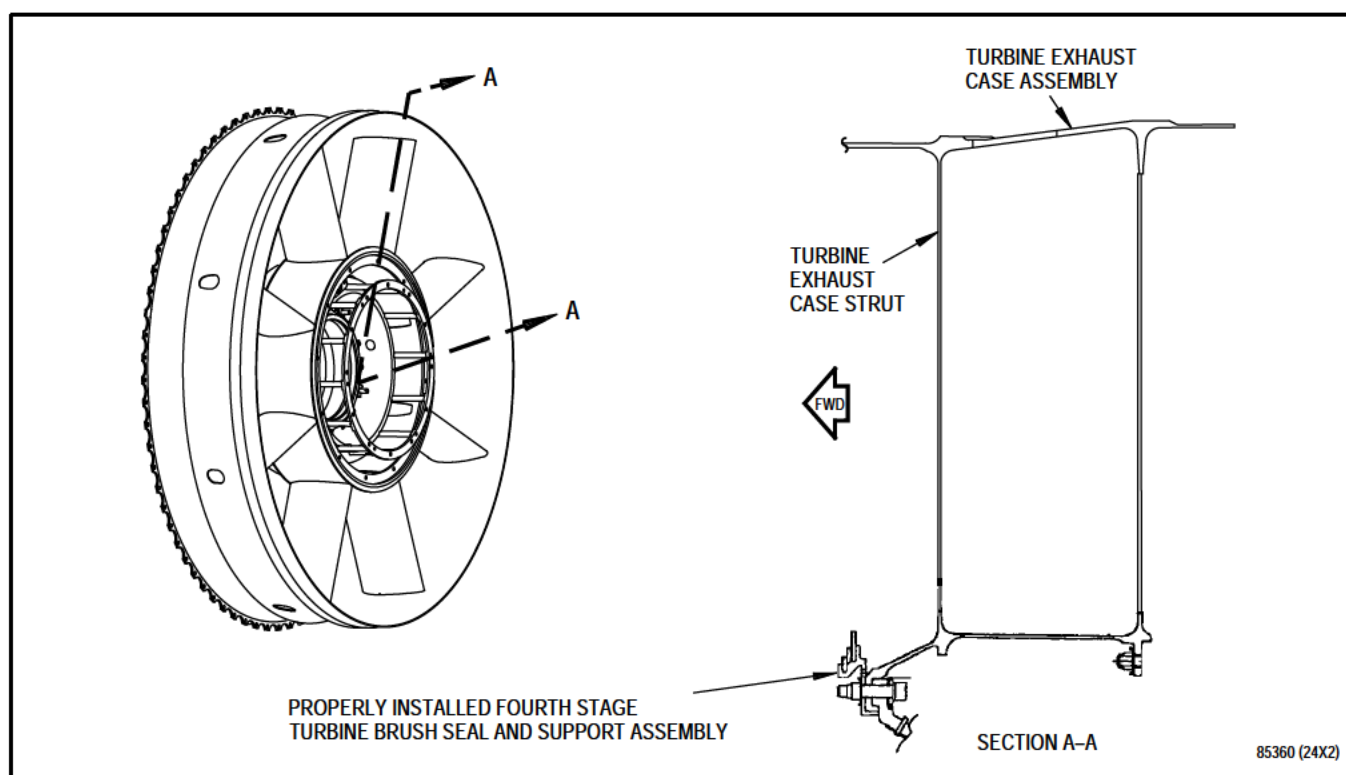


Figure 2. Fourth Stage Turbine Brush Seal and Support Assembly - Installation

3. FOURTH STAGE TURBINE AIR SEALING RING ASSEMBLY AND NO. 5 BEARING SEAL ASSEMBLY - INSTALLATION.

(See Figures 3 and 4.)

- a. Position case assembly(5, figure 3) flat on bench so both forward and aft flanges are accessible.
- b. Lubricate threads of bolts(1) with MIL-L-7808 oil.
- c. Install spacer(2) heat shields(3) aligning ends of heat shields at 3 o'clock and 9 o'clock positions onto No. 5 bearing seal assembly(4) with bolts(1) installed.
- d. Ensure gaps between spacers(2) do not overlap gaps between heat shields(3).

NOTE

No. 5 bearing pressure tube is located at 12 o'clock position, 180 degrees from dowel pin hole in outer flange.

- e. Install as a unit into turbine exhaust case(5) aligning dowel pin in seal assembly(4) with dowel pin hole in case.
- f. Ensure holes in heat shield align with support rod bosses.
- g. Position 4th stage turbine air sealing ring assembly(6) on front side of case, aligning bolt holes.



Improper installation of 4th stage turbine air sealing ring assembly can cause engine damage.

- h. Secure air sealing ring assembly(6) and No. 5 bearing seal assembly(4) with bolts(1). Ensure that air sealing ring assembly is installed with smallest of three ID seal-lands toward front of engine. Do not install backwards. (See figure 4.)
- i. Visually verify that support rod and oil tube passages in turbine exhaust case assembly align with No. 5 bearing seal assembly.
- j. Seat No. 5 bearing seal assembly(4, figure 1) into case assembly(5) by tightening bolts in pairs 180 degrees apart. Apply final torque of 27 to 30 pound-inches to bolts.

Legend for figure 3

1. Bolts
2. Spacers
3. Heatshields
4. No. 5 Bearing Seal Assembly
5. Turbine Exhaust Case Assembly
6. 4th Stage Turbine Air Sealing Ring Assembly

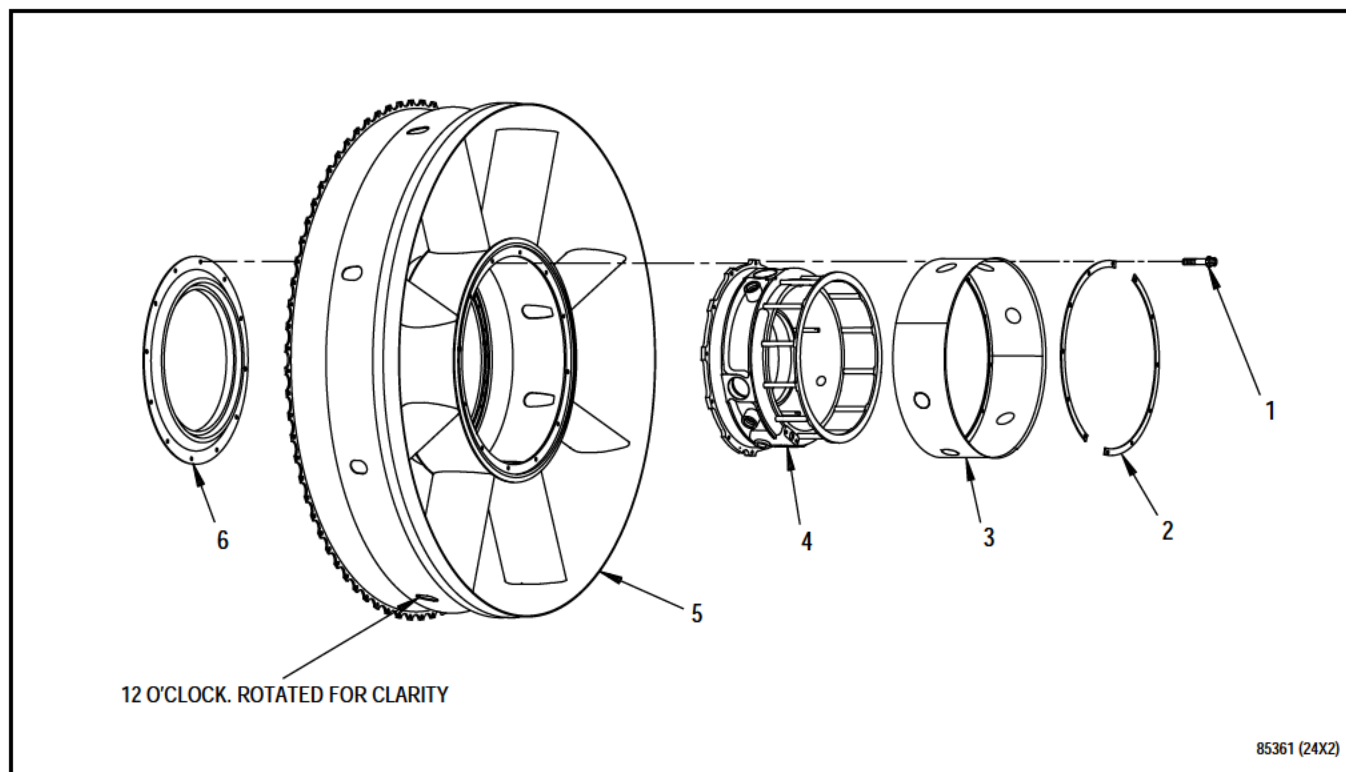


Figure 3. Fourth Stage Turbine Air Sealing Ring Assembly and No. 5 Bearing Seal Assembly - Installation

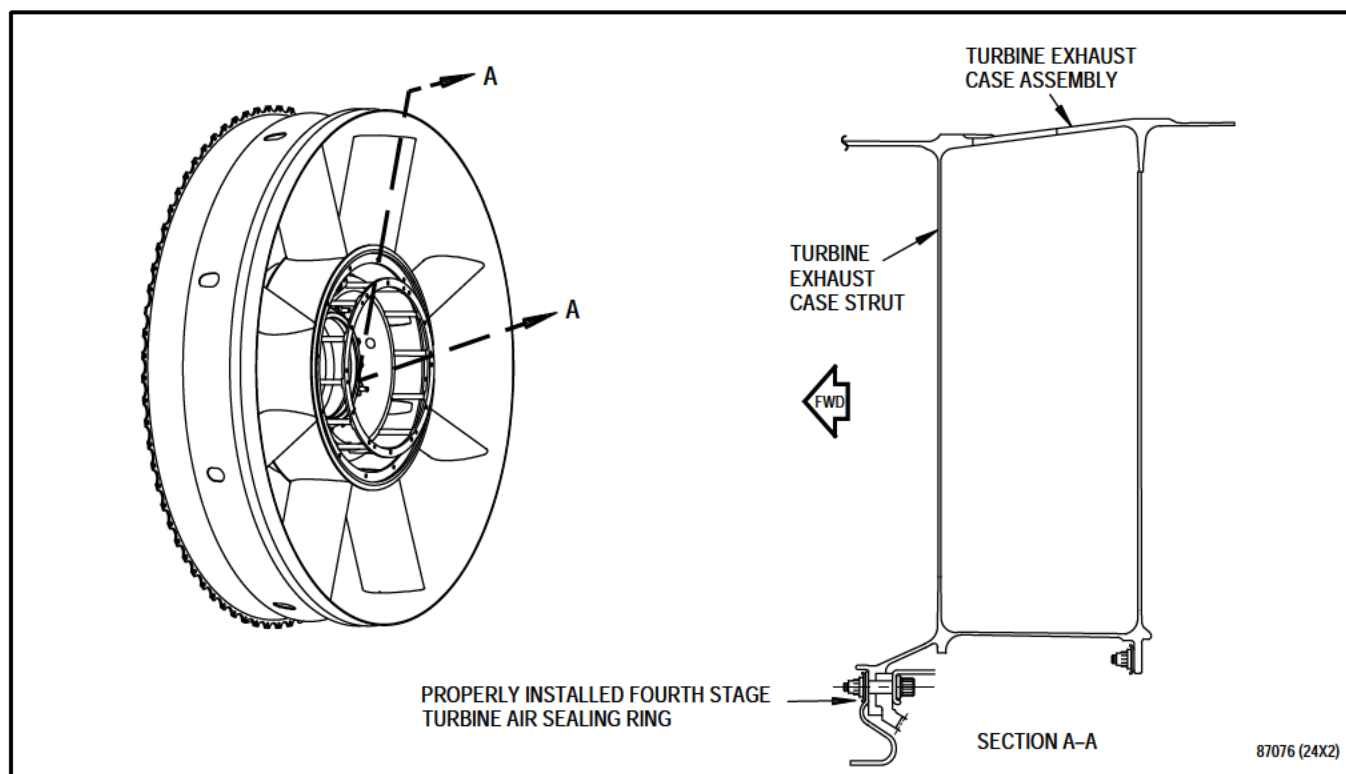


Figure 4. Fourth Stage Turbine Air Sealing Ring Assembly - Installation

4. FRONT AND REAR TURBINE EXHAUST DUCT ASSEMBLIES - INSTALLATION.

(See Figure 5.)

- a. Lubricate threads of bolts(5, figure 5) with MIL-L-7808 oil.
- b. Install rear turbine exhaust duct assembly(2) onto case assembly(1), aligning bolt holes. Install bolts(3) fingertight for future assembly.
- c. Install front turbine exhaust duct assembly(4) onto rear turbine exhaust duct assembly(2), aligning bolt holes. Secure with bolts(5).
- d. Torque bolts(5) 27 to 30 pound-inches.
- e. Maintain a 0.005 inch minimum gap between front and rear exhaust duct assemblies and turbine exhaust case assembly struts.

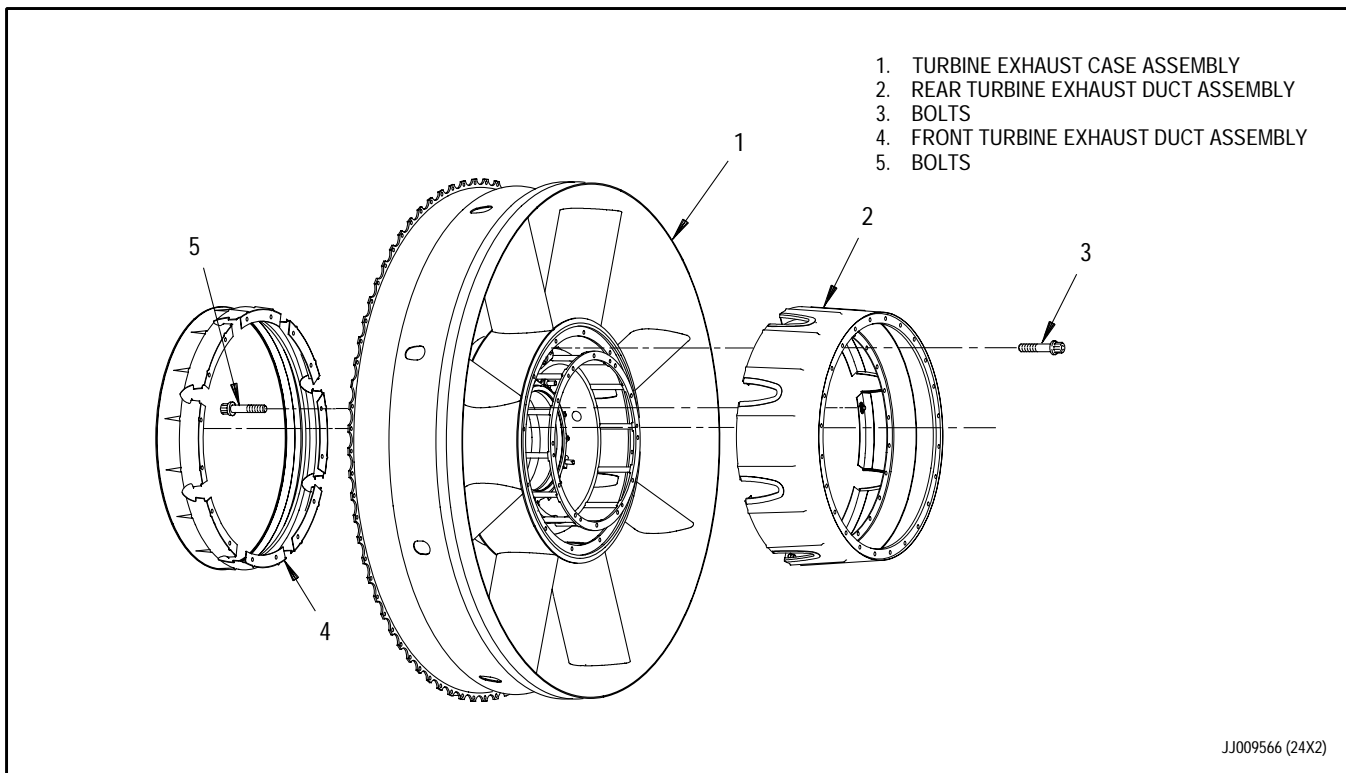


Figure 5. Front and Rear Turbine Exhaust Duct Assemblies - Installation

5. FOLLOW-ON MAINTENANCE.

- a. Install turbine exhaust case assembly per WP 701 00.

WORK PACKAGE

TECHNICAL PROCEDURES

**SUPPORT ASSEMBLY - NO. 5 BEARING INNER,
AND NO. 5 BEARING INNER RACE AND ROLLERS -**

ASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 10

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 3	21	6	21	7 - 9	16
4 - 5	0			10	21

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Oil, lubricating	MIL-L-7808

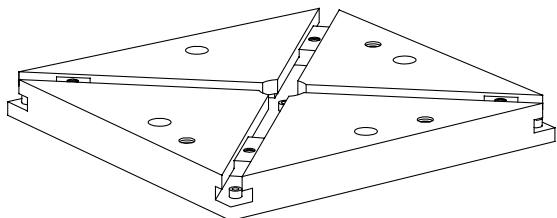
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

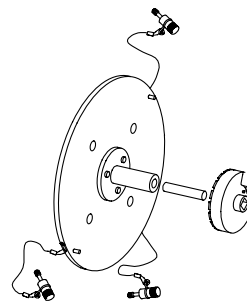
Paragraph	Function - Tool Nomenclature	Tool Number
2	No. 5 Bearing Inner Support Assembly and No. 5 Bearing Inner Race and Rollers - Assembly	
	Adapter, Holding - - - - -	PWA 21500
	Torque Fixture, No. 5 bearing retaining nut (part of PWA 57658 tool set) - - - - -	PWA 57655
	Pusher, No. 5 Bearing Inner Race - - - - -	PWA 57894

ILLUSTRATED SUPPORT EQUIPMENT



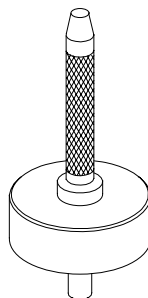
PWA 21500 -C

Figure T1. PWA 21500 Adapter



8371

Figure T2. PWA 57655 Torque Fixture



PWA 57894 -C

Figure T3. PWA 57894 PUSHER

1. INTRODUCTION.

- a. This work package contains instructions for assembly of No. 5 bearing inner support assembly and No. 5 bearing inner race and rollers.

**2. NO. 5 BEARING INNER SUPPORT
ASSEMBLY AND NO. 5 BEARING INNER RACE
AND ROLLERS - ASSEMBLY.**

(See Figure 1.)

- a. Place No. 5 bearing inner race and rollers in hot oil tank or equivalent. Heat inner race and rollers at 340° to 370°F (171° to 188°C) for 30 minutes.
- b. Install PWA 57655 detail-21 base on PWA 21500 adapter.

- c. Install No. 5 bearing inner support onto PWA 57655 detail-21 base. Rear flange shall engage alignment pins located on detail-21 base. Secure No. 5 bearing inner support to fixture with three detail-14 pins.

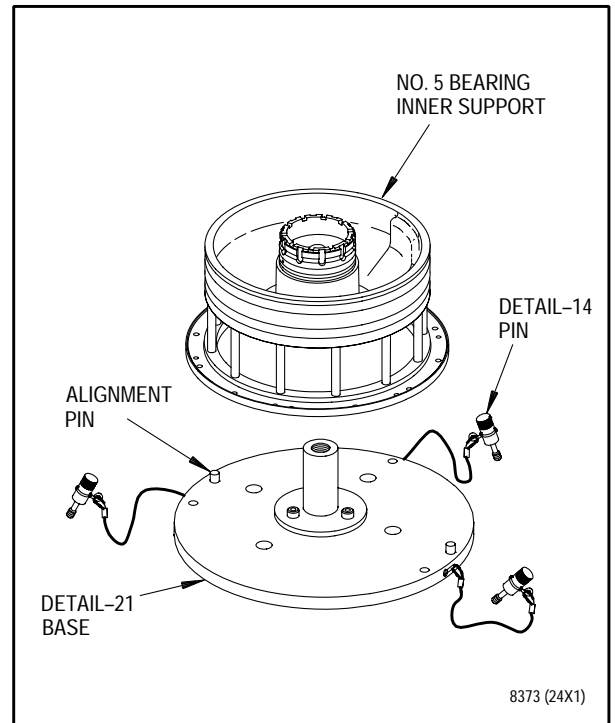


Figure 1. No. 5 Bearing Inner Support Assembly and No. 5 Bearing Inner Race and Rollers - Assembly (Sheet 1 of 6)

CAUTION

Failure to install No. 5 bearing inner race and rollers properly may result in bearing failure.

- d. Remove inner race and rollers from oil tank. Install inner race and rollers, serial number facing up, onto No. 5 bearing inner support. Seat inner race using PWA 57894 pusher and soft face mallet. Tap pusher to assure bearing inner race is fully seated. Allow assembly temperature to normalize.
- e. Install key washer.
- f. Install No. 5 bearing retaining nut by turning counterclockwise. Handtighten nut.
- g. Slide PWA 57655 detail-10 washer onto threaded end of detail-4 torque angle indicator assembly. Thread indicator assembly and washer into detail-21 base. Handtighten indicator assembly.

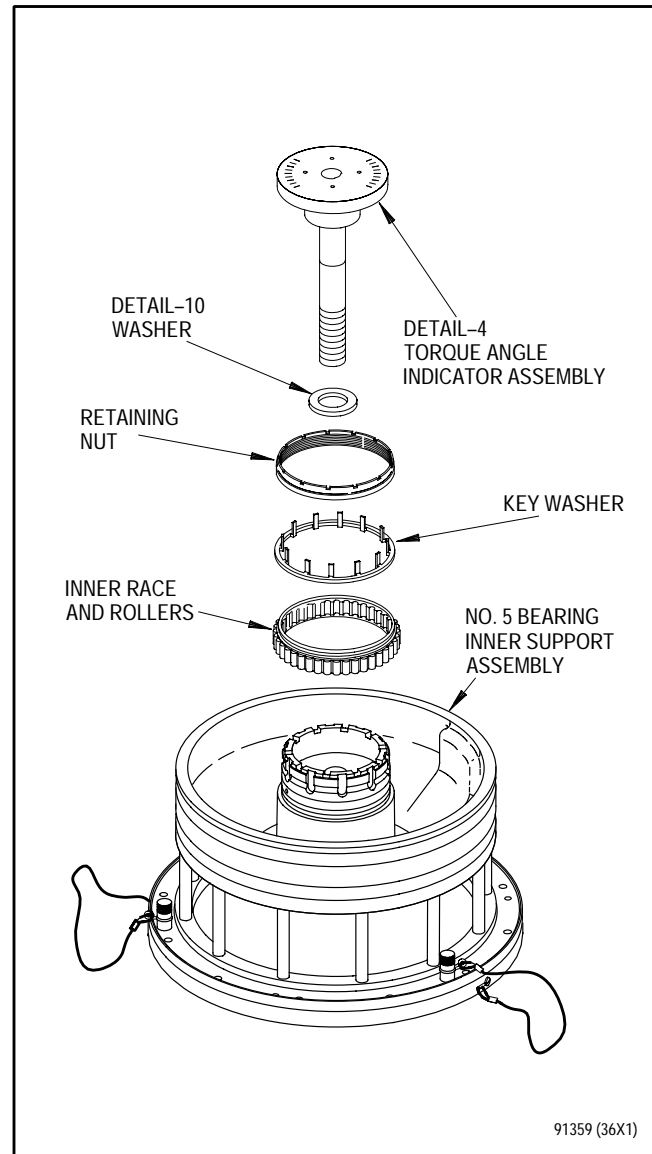


Figure 1. No. 5 Bearing Inner Support Assembly and No. 5 Bearing Inner Race and Rollers - Assembly (Sheet 2 of 6)

- h. Install detail-25 spanner wrench onto retaining nut so teeth of wrench engage slots in retaining nut.
- h1. Install detail-24 cap screw through center of spanner wrench into detail-4 torque angle indicator assembly. Handtighten cap screw, then back off approximately 1/2 turn so that detail-25 spanner wrench is free to rotate but does not disengage from retaining nut.

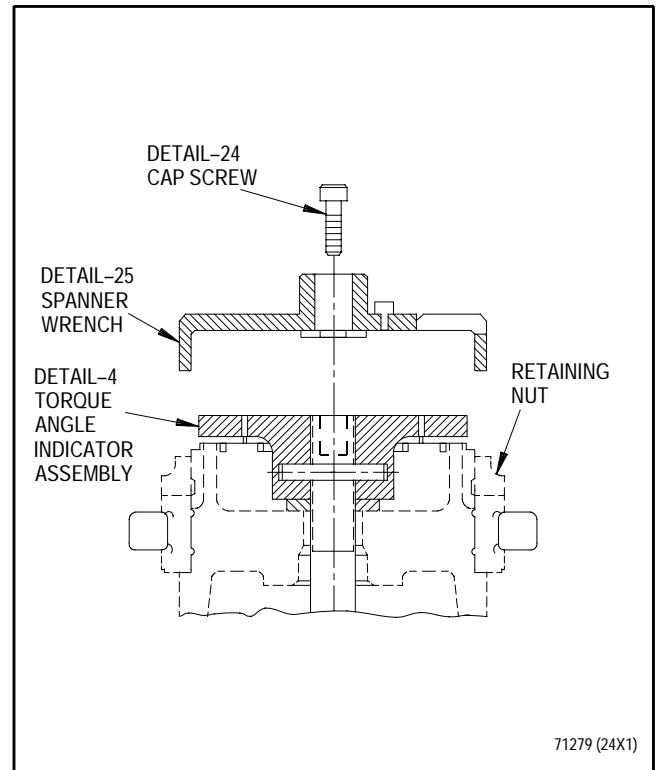


Figure 1. No. 5 Bearing Inner Support Assembly and No. 5 Bearing Inner Race and Rollers - Assembly (Sheet 3 of 6)

i. Torque retaining nut as follows:

NOTE

Retaining nut has left-hand thread.

- (1) Torque nut counterclockwise 450 to 500 pound-inches. Further tighten nut through an angle of $3^{\circ}30'$ to $5^{\circ}30'$. If necessary, remove detail-24 cap screw and position detail-25 spanner wrench so that detail-8 pointer is pointing to degree marks on detail-4 torque angle indicator. Reinstall detail-24 cap screw per step h1.
- (2) Loosen nut to zero torque.
- (3) Torque nut 450 to 500 pound-inches. Record position of detail-8 pointer. If necessary, reposition detail-25 spanner wrench per step (1). Further tighten nut through an angle of $3^{\circ}30'$ to $5^{\circ}30'$.
- (4) Loosen nut to zero torque.
- (5) Torque nut 450 to 500 pound-inches. If detail-8 pointer is in line with position recorded in step (3) or up to $0^{\circ}30'$ beyond, further tighten nut through an angle of $3^{\circ}30'$ to $5^{\circ}30'$.
- (6) If marks are not aligned within limits, repeat steps (3) through (5).
- (7) Remove detail-24 cap screw and detail-25 spanner wrench.

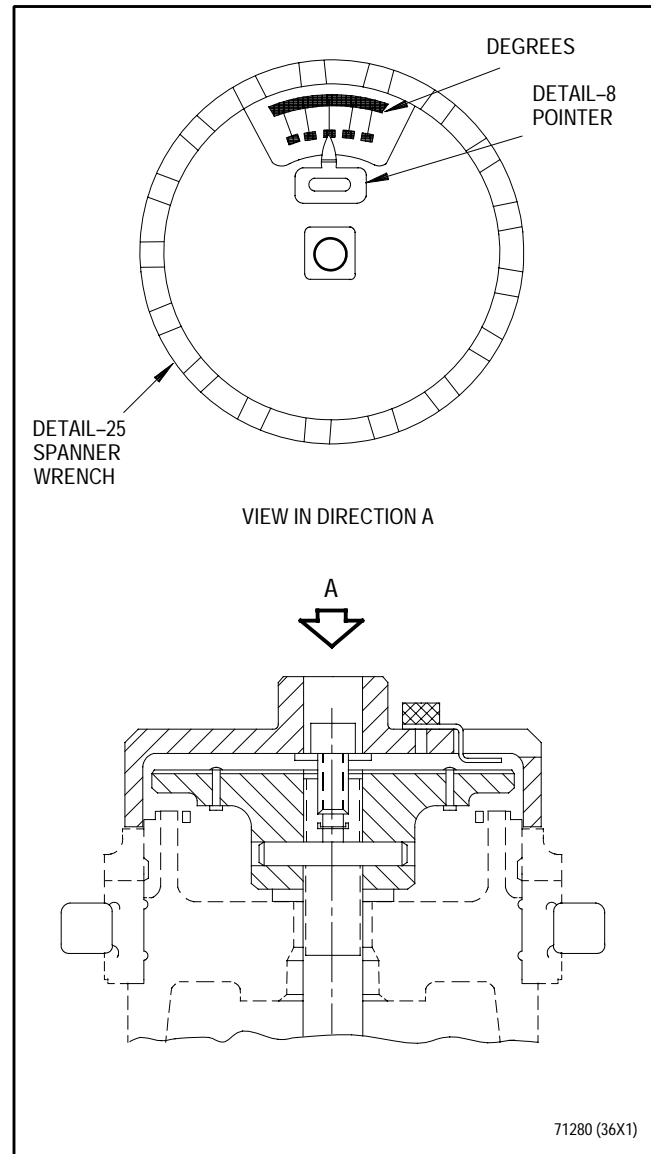


Figure 1. No. 5 Bearing Inner Support Assembly and No. 5 Bearing Inner Race and Rollers - Assembly (Sheet 4 of 6)

- j. Using 0.001 inch feeler gage, verify inner race is fully seated. Attempt to insert gage between inner race and support. If gage can be inserted, remove inner race and rollers per WP 030 00, and install per this paragraph.
- j1. Remove detail-4 torque angle indicator assembly.

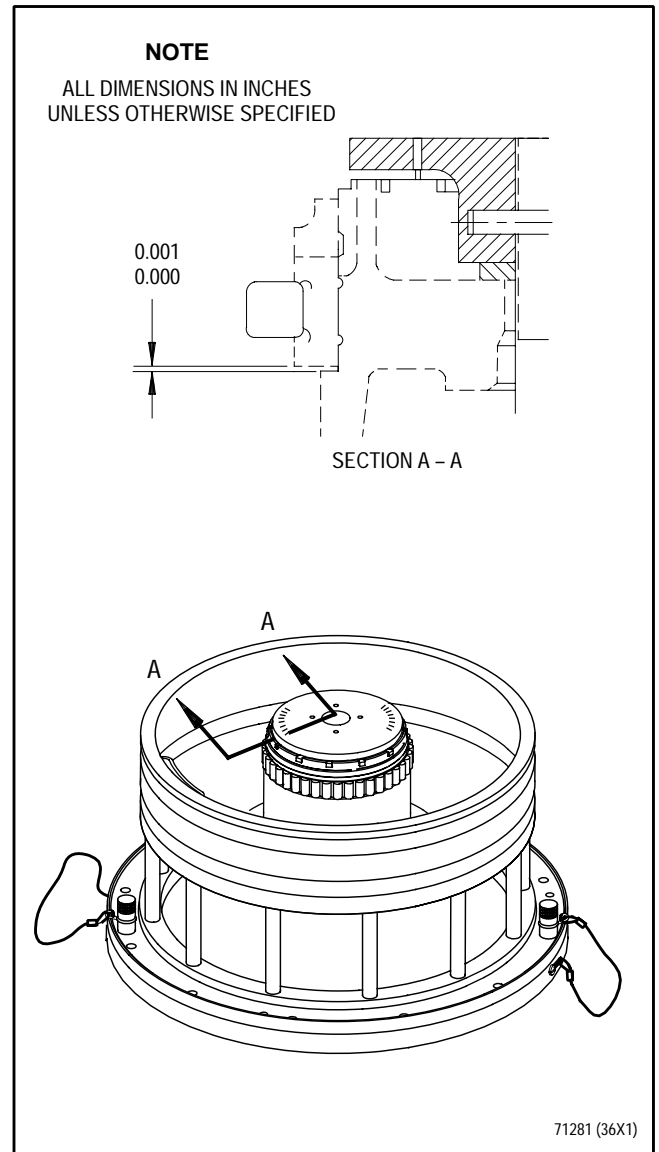


Figure 1. No. 5 Bearing Inner Support Assembly and No. 5 Bearing Inner Race and Rollers - Assembly (Sheet 5 of 6)

- k. Bend tabs on key washers into retaining nut. If slots on retaining nut are not aligned with tabs of key washers, tighten nut until next slot in nut aligns with tabs.
- l. Remove No. 5 bearing inner support from PWA 57655 detail-21 base. Coat inner race and rollers with MIL-L-7808 lubricating oil and place support in a protective container.

3. FOLLOW-ON MAINTENANCE.

- a. Install No. 5 bearing inner support assembly and inner race and rollers per WP 701 00.

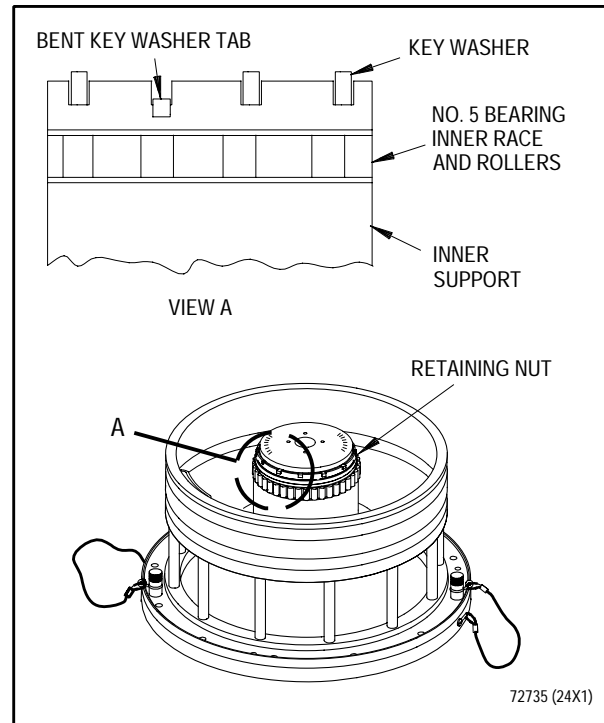


Figure 1. No. 5 Bearing Inner Support Assembly and No. 5 Bearing Inner Race and Rollers - Assembly (Sheet 6 of 6)

Figure 2. Deleted.

WORK PACKAGE**TECHNICAL PROCEDURES****ROTOR AND STATOR ASSEMBLY, TURBINE, FRONT COMPRESSOR DRIVE -****ASSEMBLY****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 66

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	28	17 - 20	0	34	28
2A Added	27	21 - 22	13	35	0
2B Blank Added	27	22A Deleted	10	36	25
3 - 4C	28	22B Blank Deleted	10	37	17
4D Blank Added	28	23	3	38	25
5	19	24	0	39	28
6	27	25 - 26 Deleted	28	40 - 41	0
7 - 8	19	26A	28	42 - 43	26
9	28	26B	9	44 - 46	0
10 - 10A	26	27	28	47	15
10B	27	28	0	48 - 49	16
11	0	29	28	50	15
12	13	30	13	51	12
13 - 14A	15	31	19	52 - 54	27
14B Blank	15	32	13	55	0
15	0	33	17	56 Blank	0
16	13				

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Propeller and Engine Shaft Wrenches - - - - -	T.O. 32A5-2-2-1
Wrench, Hydraulic, PWA 50308 - - - - -	T.O. 32B14-5-2-1

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T.O. No.	Date	Level	Title (ECP No.)
2J-F100229-553	15 Feb 1995	O/I	Modification of PWA 57653 Tool Set, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 94QC004-1)
2J-F100229-554	15 Feb 1995	O/I	Modification of PWA 57704 Adapter, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 89QA624-1)
2J-F100229-587	15 Oct 1998	O/I	Reoperation of PWA 57753 Hydraulic Pusher, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 94QC005)
2J-F100229(III)-508	01 Mar 1994	O/I	Install Improved Durability Fourth Blade Outer Air Seal, F100-PW-229 Engine, F-15/F-16 Aircraft. (ECP 91QA300)
2J-F100229(III)-516	15 Feb 1995	O/I	Remove and Replace Second Stage Turbine Duct Support and Segment, F100-PW-229 Engines, F-15/F-16. (ECP 90QA218)
2J-F100229(III)-517	15 Feb 1995	D	Installation of Improved Durability 4th Stage Turbine Blade PN 4082504, Disk PN 4082604, and Air Seal PN 4082297, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 93QA253R1C1)
2J-F100229(III)-518	15 Feb 1995	O/I	Installation of Improved Durability 4th Stage Turbine Blade PN 4082504, Disk PN 4082604, and Air Seal PN 4082297, F100-PW-229 Engines, F-15 Aircraft. (ECP 93QA253R1)

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
ACETONE (PMC 9008)	O-A-51
COMPOUND, ANTIGALLING (PWA 36035)	FEL-PRO C-300
COMPOUND, ANTIGALLING (PWA 36053-3)	LOCTITE NICKEL ANTI-SEIZE 771
COMPOUND, ANTIGALLING (PWA 36545-3)	ESNALUBE 382
PENCIL (CRAYON), SILVER, METAL	COLORBRITE NO. 2101
MARKING (HARD)	OR
	COLOR-TEX NO. 1843
	OR
	ANADEL NO. 1936

EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Key washer	4064559	6

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	FAN DRIVE TURBINE MODULE BUILD STAND - ASSEMBLY	
	ADAPTER, FAN DRIVE TURBINE MODULE TO VERTICAL BUILD STAND - - - - -	PWA 57818 OR
	ADAPTER, FDT MODULE TO VERTICAL STAND - - - - -	PWA 57704 NSN
	STAND, VERTICAL BUILD - - - - -	4920-00-670-2592
2A	REAR TURBINE CASE ASSEMBLY - INSTALLATION OF SECOND STAGE TURBINE DUCT SUPPORT AND SEGMENTS	
	DRIVER, DUCT SEGMENTS - - - - -	PWA 53354
	CLAMP - - - - -	LM 1021
2B	REAR TURBINE CASE INSTRUMENTATION AND BORESCOPE BOSSES - INSTALLATION	
	FIXTURE, ASSEMBLY LPT CASE BOSSES - - - - -	PWA 57738
6	THIRD STAGE TURBINE DISK AND BLADES AND TURBINE REAR HUB ASSEMBLY - INSTALLATION	
	TOOL SET, FAN DRIVE TURBINE ROTOR, ASSEMBLY/ DISASSEMBLY - - - - -	PWA 57810 OR
	SET, TOOL, FAN DRIVE TURBINE ROTOR ASSY - - - - -	PWA 57653
8A	FOURTH STAGE TURBINE AIR SEALING RING SEGMENTS (14 SEGMENT CONFIGURATION TIP SHROUD) AND SUPPORT - INSTALLATION	
	HEATER, TURBINE REAR HUB ID - - - - -	PWA 56326
9	FOURTH STAGE TURBINE AIR SEAL - INSTALLATION ONTO FOURTH STAGE TURBINE DISK AND BLADES	
	HEATER, TURBINE REAR HUB ID - - - - -	PWA 56326
	TOOL SET, FAN DRIVE TURBINE ROTOR, ASSEMBLY/ DISASSEMBLY - - - - -	PWA 57810 OR
	SET, TOOL, FAN DRIVE TURBINE ROTOR ASSY - - - - -	PWA 57653

APPLICABLE SUPPORT EQUIPMENT (continued)

Paragraph	Function - Tool Nomenclature	Tool Number
10	FOURTH STAGE TURBINE DISK, BLADES, AND AIR SEAL - INSTALLATION	
	TOOL SET, FAN DRIVE TURBINE ROTOR, ASSEMBLY/ DISASSEMBLY - - - - -	PWA 57810 OR
	SET, TOOL, FAN DRIVE TURBINE ROTOR ASSY - - - - -	PWA 57653
	HEATER, TURBINE EXHAUST CASE - - - - -	PWA 57886 OR
	HEATER, TURBINE REAR HUB - - - - -	PWA 56322 OR
	HEATER, TURBINE REAR HUB - - - - -	PWA 51777
	CONTROL, HEATER - - - - -	PWA 61685 OR
	CONTROL, HEATER - - - - -	PWA 25672
	PUMP, HYDRAULIC - - - - -	PWA 51946
	TOOL, ASSEMBLY, LOW TURBINE TIEROD (PART OF PWA 57810 TOOL SET) - - - - -	PWA 57528
	ADAPTER, TORQUE SET - INSTALL/REMOVE LOW TURBINE TIE BOLTS (PART OF PWA 57810 TOOL SET) - - - - -	PWA 57809
	CRIMPER, KEY WASHER - - - - -	PWA 52556
11	FRONT COMPRESSOR DRIVE TURBINE SHAFT ASSEMBLY - INSTALLATION INTO TURBINE REAR HUB	
	HEATER, TURBINE REAR HUB ID - - - - -	PWA 56326
	PULLER, HYDRAULIC FRONT COMPRESSOR DRIVE TURBINE SHAFT - - - - -	PWA 57812 OR
	PUSHER, HYDRAULIC, FDT SHAFT ASSY - - - - -	PWA 57753
	EYE, LIFTING - - - - -	PWA 51026
	PUMP, HYDRAULIC - - - - -	PWA 55380
11A	NO. 5 BEARING HEAT SHIELD AND BEARING PLUG - INSTALLATION	
	PUSHER, FAN DRIVE TURBINE SHAFT HEAT SHIELD - - - - -	PWA 51059
	PUMP, HYDRAULIC - - - - -	PWA 55380
	HEATER, LOW TURBINE SHAFT NO. 5 BEARING OUTER RACE -	PWA 51932
	PUSHER, NO. 5 BEARING PLUG INTO TURBINE SHAFT - - - -	PWA 51049

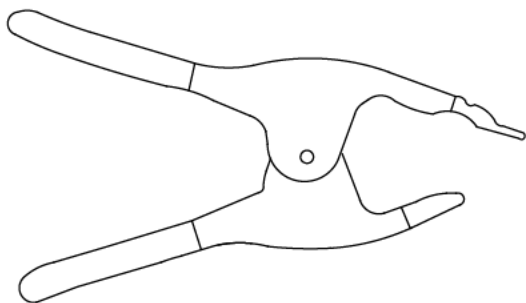
APPLICABLE SUPPORT EQUIPMENT (continued)

Paragraph	Function - Tool Nomenclature	Tool Number
12	FRONT COMPRESSOR DRIVE TURBINE ROTOR AND STATOR - INSTALLATION INTO PWA 56338 STAND FOR FRONT COMPRESSOR DRIVE TURBINE SHAFT NUT INSTALLATION	
	SPACER, FAN DRIVE TURBINE, REAR BALANCE BEARING - - -	PWA 56729 OR
	SPACER, FAN DRIVE TURBINE REAR BALANCE - - - - -	PWA 51045
	HEATER, NO. 5 BEARING OUTER RACE AND PLUG - - - - -	PWA 51932
	CONTROL, HEATER - - - - -	PWA 25672
	BALANCE BEARING, FAN DRIVE TURBINE REAR - - - - -	PWA 51046
	PUSHER - - - - -	PWA 51049
	WRENCH - - - - -	PWA 51048 OR
	WRENCH - - - - -	PWA 50308
	HOLDER - - - - -	PWA 51051 OR
	HOLDER - - - - -	PWA 51960 WITH SAALC X 8750370
	FIXTURE, BALANCE FRONT COMPRESSOR DRIVE ROTOR AND STATOR ASSEMBLY, REAR - - - - -	PWA 57715
	SLING, HANDLING - - - - -	PWA 6580
	TRUNNION ADAPTER (TWO REQUIRED) - - - - -	PWA 26147
	RETAINER, FAN DRIVE TURBINE MODULE, FRONT (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57819 OR
	RETAINER ASSEMBLY - - - - -	PWA 57648 OR
	RETAINER, FRONT, FAN DRIVE TURBINE MODULE - - - - -	PWA 56682
	ADAPTER, FRONT COMPRESSOR DRIVE TURBINE SUPPORT - - -	PWA 57839 OR
	ADAPTER, FDT MODULE TO STAND SHAFT LIP - - - - -	PWA 57708 OR
	ADAPTER, FRONT COMPRESSOR DRIVE TURBINE SUPPORT, STAND - - - - -	PWA 51719
	STAND, STORAGE AND DISASSY, VARIOUS MODULES - - - - -	PWA 56338 OR
	STAND, INLET FAN MODULE STORAGE AND DISASSY - - - - -	PWA 50775
	EYE, LIFTING - - - - -	PWA 51056

APPLICABLE SUPPORT EQUIPMENT (continued)

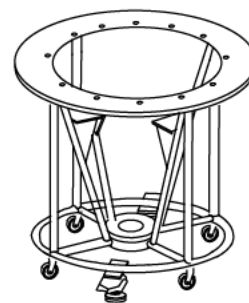
Paragraph	Function - Tool Nomenclature	Tool Number
13	FRONT COMPRESSOR DRIVE TURBINE SHAFT NUT - INSTALLATION AND TORQUE PROCEDURE	
	GUIDE, TURBINE SHAFT WRENCH - - - - -	PWA 51721
	INDICATOR - - - - -	PWA 51723
	ADAPTER, TURBINE SHAFT RETAINING NUT WRENCH - - - - -	PWA 52649
	ADAPTER, TORQUE TURBINE HUB RETAINING NUT - - - - -	PWA 56671
		OR
	WRENCH, TURBINE SHAFT RETAINING NUT - - - - -	PWA 53340
	WRENCH, HYDRAULIC - - - - -	PWA 50308
	SLING - - - - -	SWE 81001/81002
	TORQUE MULTIPLIER - - - - -	SWE 8100/8200

ILLUSTRATED SUPPORT EQUIPMENT



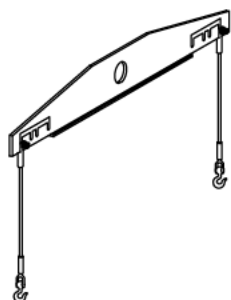
LM 1021 -C

Figure T1. LM 1021 CLAMP



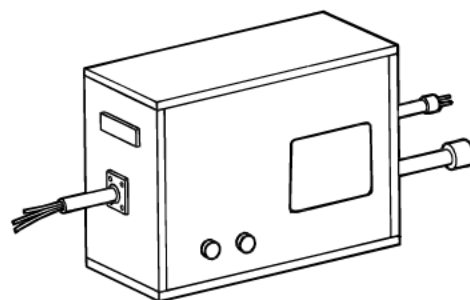
NSN4920-00-670-2592 -C

Figure T2. NSN 4920-00-670-2592 STAND



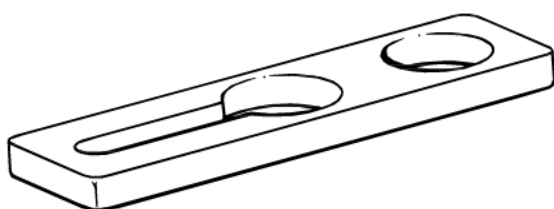
PWA 6580 -C

Figure T3. PWA 6580 SLING



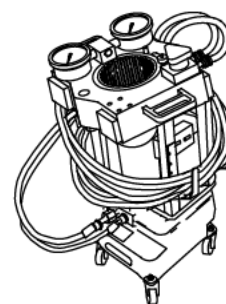
PWA 25672 -C

Figure T4. PWA 25672 CONTROL



PWA 26147 -C

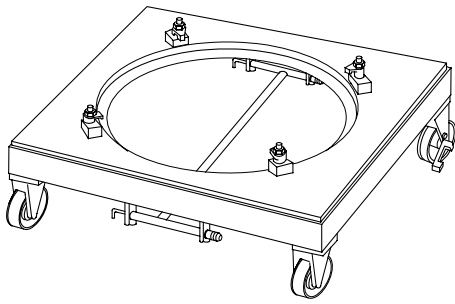
Figure T5. PWA 26147 TRUNNION ADAPTER
(TWO REQUIRED)



PWA 50308 -C

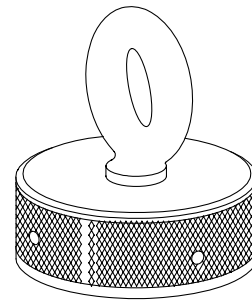
Figure T6. PWA 50308 WRENCH

ILLUSTRATED SUPPORT EQUIPMENT (continued)



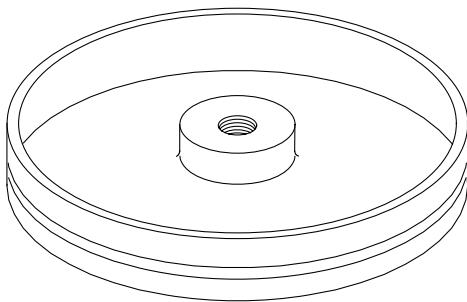
PWA 50775 -C

Figure T7. PWA 50775 STAND



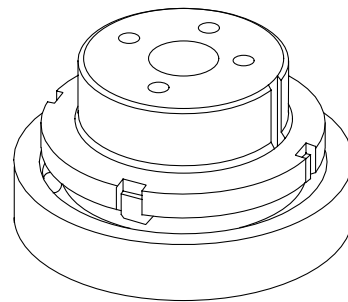
PWA 51026 -C

Figure T8. PWA 51026 EYE



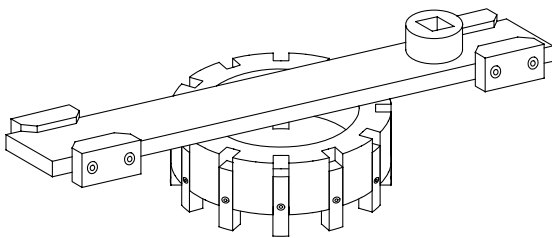
PWA 51045 -C

Figure T9. PWA 51045 SPACER



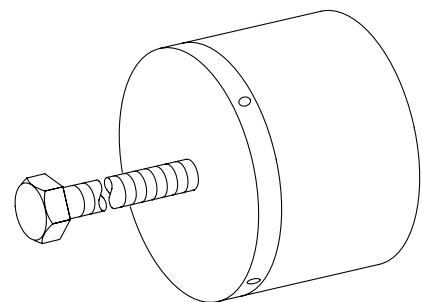
PWA 51046 -C

Figure T10. PWA 51046 BALANCE BEARING



PWA 51048 -C

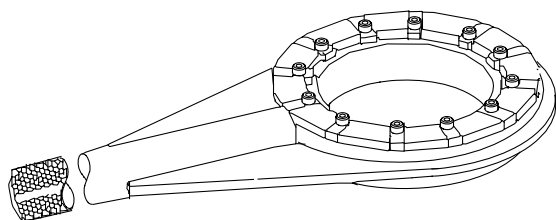
Figure T11. PWA 51048 WRENCH



PWA 51049 -C

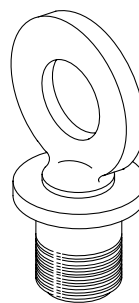
Figure T12. PWA 51049 PUSHER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



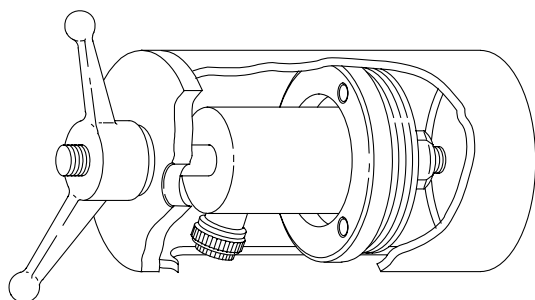
PWA 51051 -C

Figure T13. PWA 51051 HOLDER



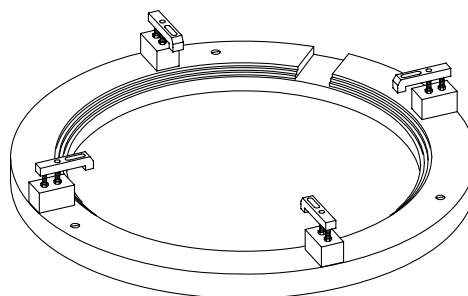
PWA 51056 -C

Figure T14. PWA 51056 EYE



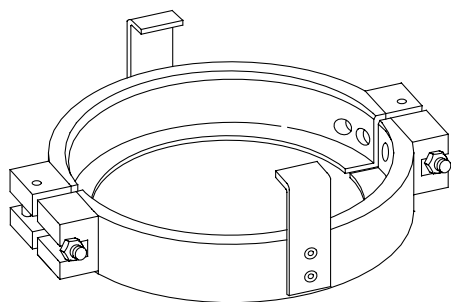
PWA 51059 -C

Figure T15. PWA 51059 PUSHER



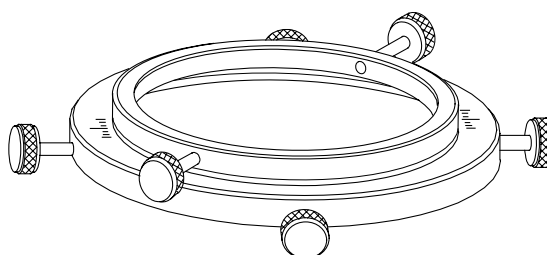
PWA 51719 -C

Figure T16. PWA 51719 ADAPTER



PWA 51721 -C

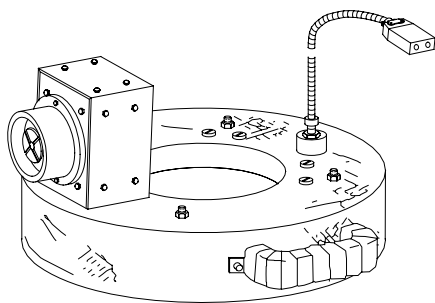
Figure T17. PWA 51721 GUIDE



PWA 51723 -C

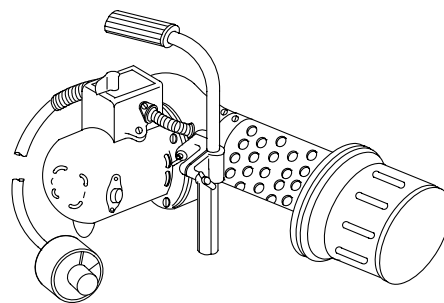
Figure T18. PWA 51723 INDICATOR

ILLUSTRATED SUPPORT EQUIPMENT (continued)



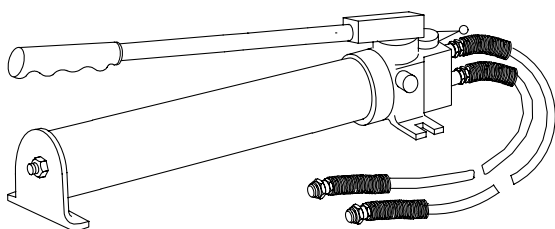
PWA 51777-C

Figure T19. PWA 51777 HEATER



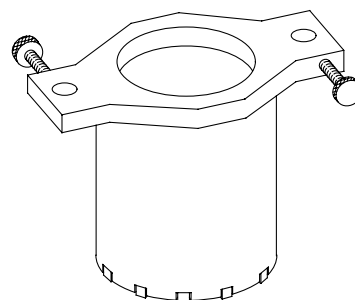
PWA 51932-C

Figure T20. PWA 51932 HEATER



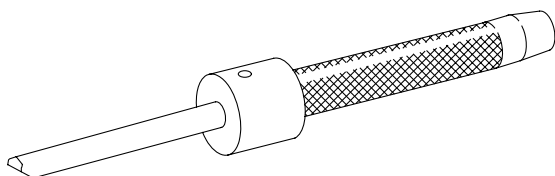
PWA 51946-C

Figure T21. PWA 51946 PUMP



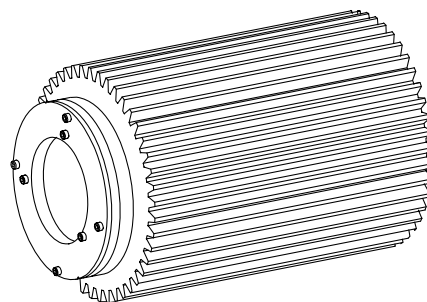
PWA 51960-C

Figure T22. PWA 51960 HOLDER



PWA 52556-C

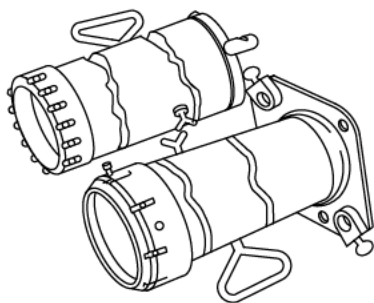
Figure T23. PWA 52556 CRIMPER



PWA 52649-C

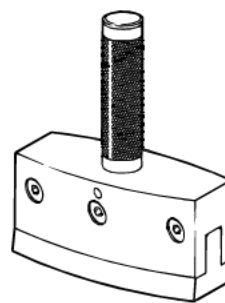
Figure T24. PWA 52649 ADAPTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



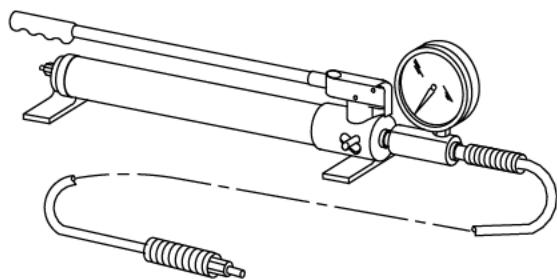
PWA 53340 -C

Figure T25. PWA 53340 WRENCH



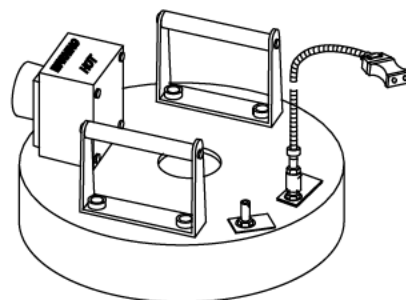
PWA 53354 -C

Figure T26. PWA 53354 DRIVER



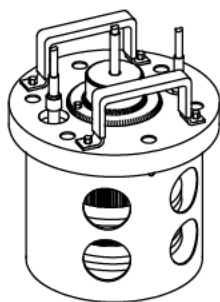
PWA 55380 -C

Figure T27. PWA 55380 PUMP



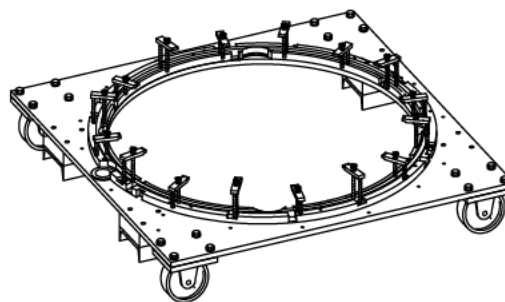
PWA 56322 -C

Figure T28. PWA 56322 HEATER



PWA 56326 -C

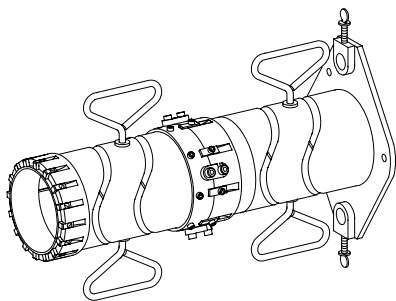
Figure T29. PWA 56326 HEATER



PWA 56338 -C

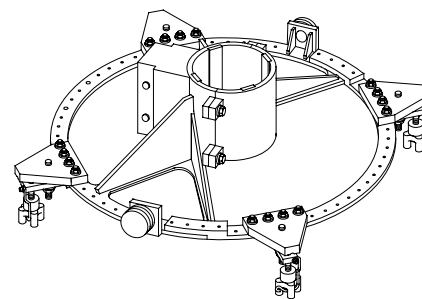
Figure T30. PWA 56338 STAND

ILLUSTRATED SUPPORT EQUIPMENT (continued)



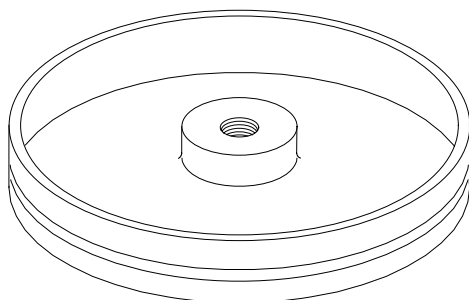
PWA 56671 -C

Figure T31. PWA 56671 ADAPTER



PWA 56682 -C

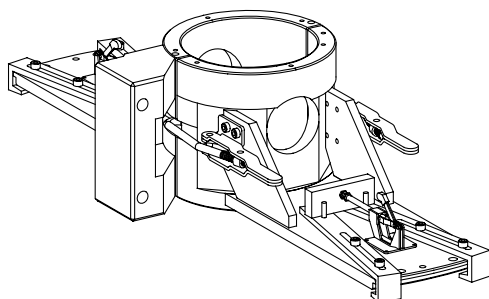
Figure T32. PWA 56682 RETAINER



PWA 56729 -C

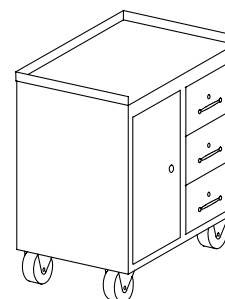
Figure T33. PWA 56729 SPACER

Figure T34. Deleted.



PWA 57648 -C

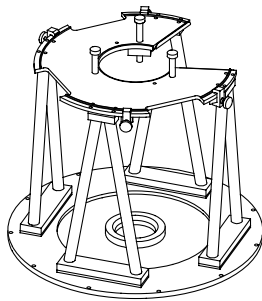
Figure T35. PWA 57648 RETAINER ASSEMBLY



PWA 57653 -C

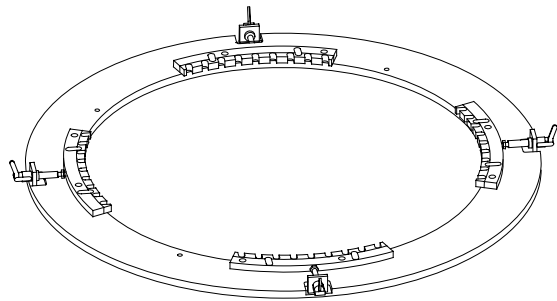
Figure T36. PWA 57653 SET

ILLUSTRATED SUPPORT EQUIPMENT (continued)



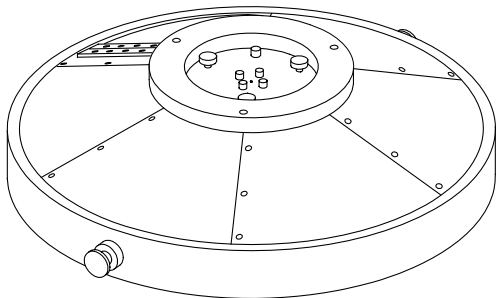
PWA 57704 -C

Figure T37. PWA 57704 ADAPTER



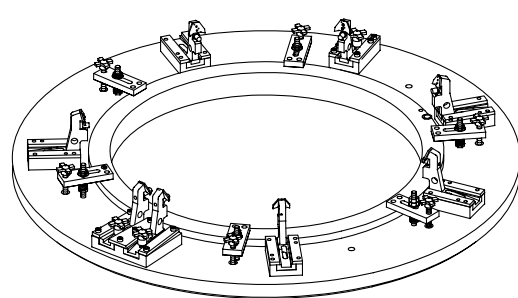
PWA 57708 -C

Figure T38. PWA 57708 ADAPTER



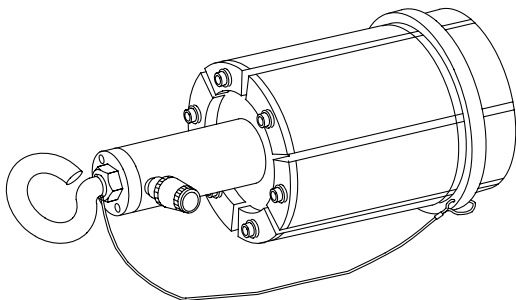
PWA 57715 -C

Figure T39. PWA 57715 FIXTURE



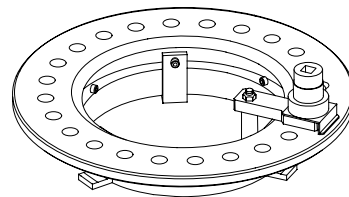
PWA 57738 -C

Figure T40. PWA 57738 FIXTURE



PWA 57753 -C

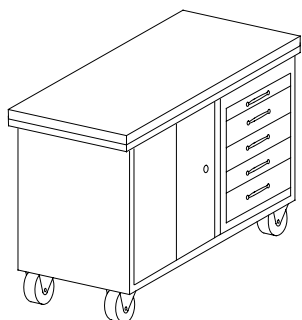
Figure T41. PWA 57753 PUSHER



PWA 57809 -C

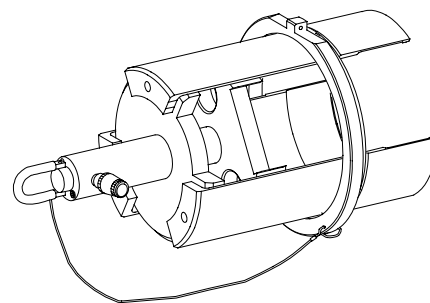
Figure T42. PWA 57809 ADAPTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



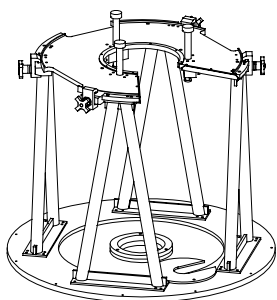
PWA 57810 -C

Figure T43. PWA 57810 TOOL SET



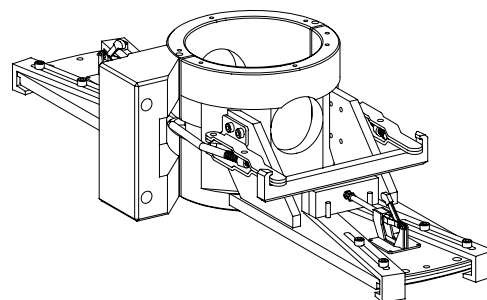
PWA 57812 -C

Figure T44. PWA 57812 PULLER



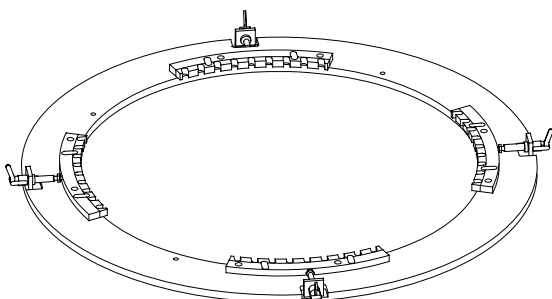
PWA 57818 -C

Figure T45. PWA 57818 ADAPTER



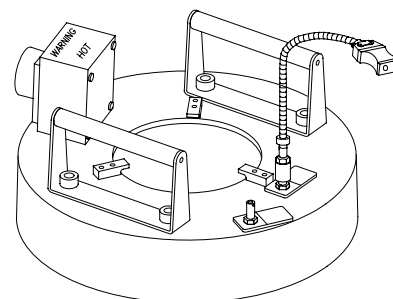
PWA 57819 -C

Figure T46. PWA 57819 RETAINER



PWA 57839 -C

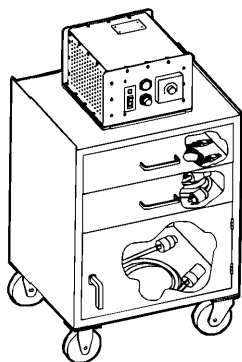
Figure T47. PWA 57839 ADAPTER



PWA 57886 -C

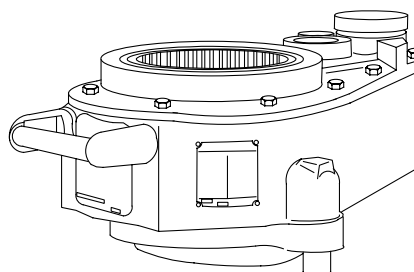
Figure T48. PWA 57886 HEATER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



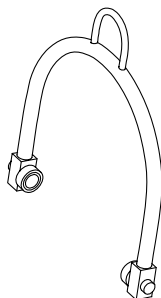
PWA 61685 -C

Figure T49. PWA 61685 CONTROL



SWE 8200 -C

Figure T50. SWE 8100/8200 TORQUE MULTIPLIER



SWE 81002 -C

Figure T51. SWE 81001/81002 SLING

1. INTRODUCTION.

a. This work package contains instructions for assembling front compressor drive turbine rotor and stator assembly. The following major parts are installed:

- Instrumentation and borescope bosses
- Third stage turbine stator assembly
- Third stage turbine disk and blades and turbine rear hub assembly
- Fourth stage turbine stator assembly
- Fourth stage turbine air seal
- Fourth stage disk and blades
- Fourth stage turbine air sealing ring segments and support assembly
- Front compressor drive turbine shaft
- No. 5 bearing heat shield and bearing plug
- Second stage turbine duct segments and second stage duct support

2. FAN DRIVE TURBINE MODULE BUILD STAND - ASSEMBLY.

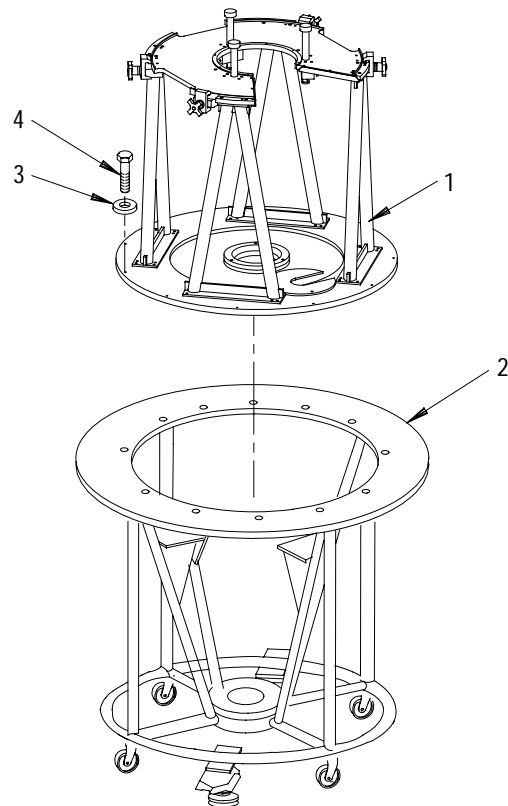
(See Figure 1.)

NOTE

For lower working height, leave
PWA 57818 adapter on floor.
However, adapter shall be
installed on NSN

4920-00-670-2592 stand before
turbine shaft can be installed.

- a. Install PWA 57818 adapter(1,
figure 1) on NSN
4920-00-670-2592 stand(2).
Secure with washers(3) and
hex-head cap screws(4).



61991 (36X2)

1. PWA 57818 adapter
2. NSN 4920-00-670-2592 vertical build stand
3. Washer
4. Hex-head cap screw

Figure 1. Fan Drive Turbine Module Build Stand - Assembly

2A. REAR TURBINE CASE ASSEMBLY - INSTALLATION OF SECOND STAGE TURBINE DUCT SUPPORT AND SEGMENTS.

(See Figure 1A.)

NOTE

Duct segments are numbered one through 20 and corresponding installation position numbers are marked on support.

- a. Place second stage turbine duct support(1, figure 1A) on bench front face down.
- b. Arrange second stage turbine duct segments(2) one through 20 on bench in sequence clockwise.



Failure to install duct segments in correct position in duct support can result in turbine damage during engine operation.

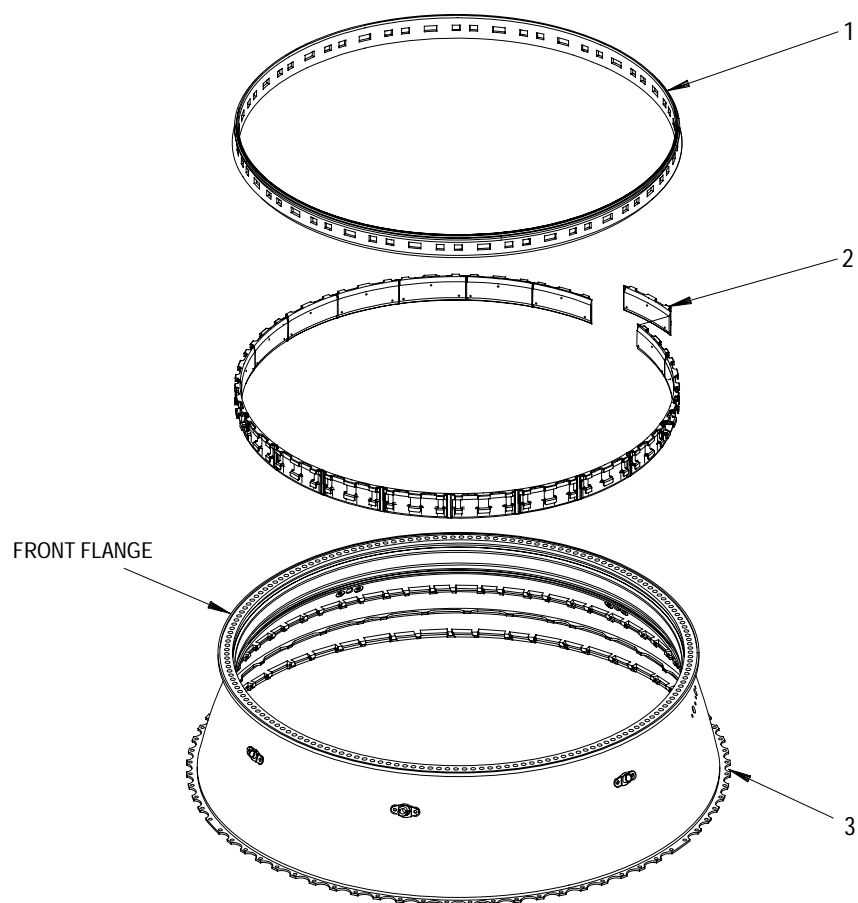
- c. Install segments in support in sequence clockwise by engaging segment rear hooks with slots in support.
- d. Seat segments in support using PWA 53354 driver.

- e. Place rear turbine case assembly(3) on bench rear flange down.



Failure to install support and duct set in correct position in rear turbine case can result in turbine damage during engine operation.

- f. Install support and duct set in turbine case aligning O mark on forward face of support within 0.060 inch of dowel pin on turbine case front flange.
- g. If necessary, tap support and duct set into case using PWA 53354 driver.
- h. Ensure support is seated with forward face of support 0.000 to 0.005 inch below forward case flange.
- i. Install two LM 1021 clamps 180 degrees apart to hold duct segment support in place.



72533 (36X2)

1. Second stage turbine duct support
2. Second stage turbine duct segments
3. Rear turbine case assembly

Figure 1A. Rear Turbine Case Assembly - Installation of Second Stage Turbine Duct Support and Segments

**2B. REAR TURBINE CASE INSTRUMENTATION
AND BORESCOPE BOSSES - INSTALLATION.**

(See Figure 1B.)

- a. Install rear turbine case(1, figure 1B) front flange into PWA 57738 fixture(2), aligning dowel pin on front flange with bushing in fixture. Remove LM 1021 clamps, if installed, from front flange before case is fully seated.
- b. Secure case to fixture with six strap clamps(3) while tightening hand knobs.
- c. Insert locating pins(4) into bosses.
- d. Move slides(5) inward until bosses contact turbine case.
- e. Tighten hand knobs(6).
- f. Secure bosses to case using bolts, heads inward and nuts. Torque 23 to 26 pound-inches.
- g. Retract slides, loosen strap clamps and swing away from turbine case.
- h. Remove turbine case from fixture. Install two LM 1021 clamps 180 degrees apart on front flange to hold second stage turbine duct support in place.

Legend for figure 1B

1. Rear turbine case
2. PWA 57738 fixture
3. Strap clamp and hand knob
4. Locating pins
5. Slide
6. Hand knob

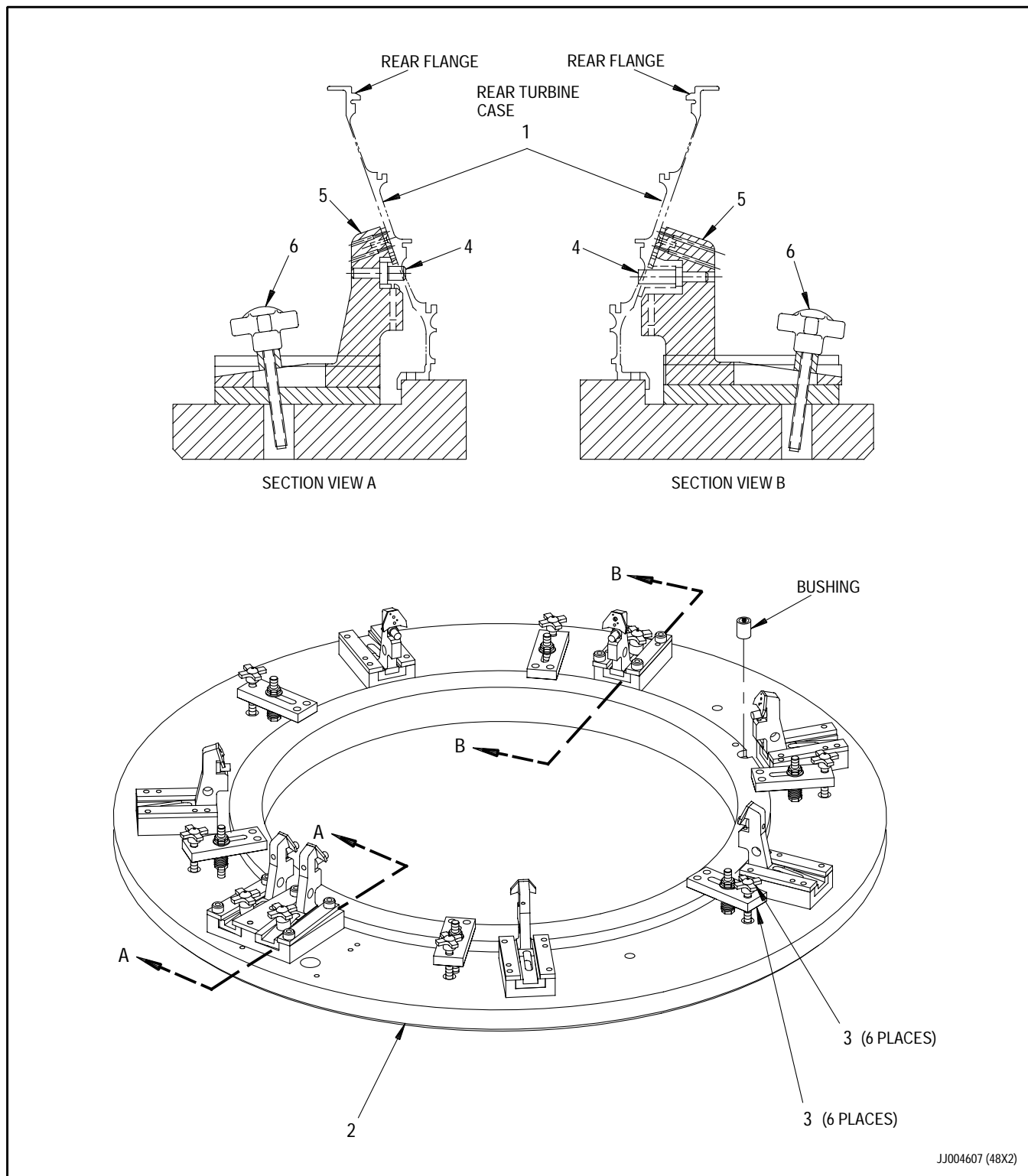


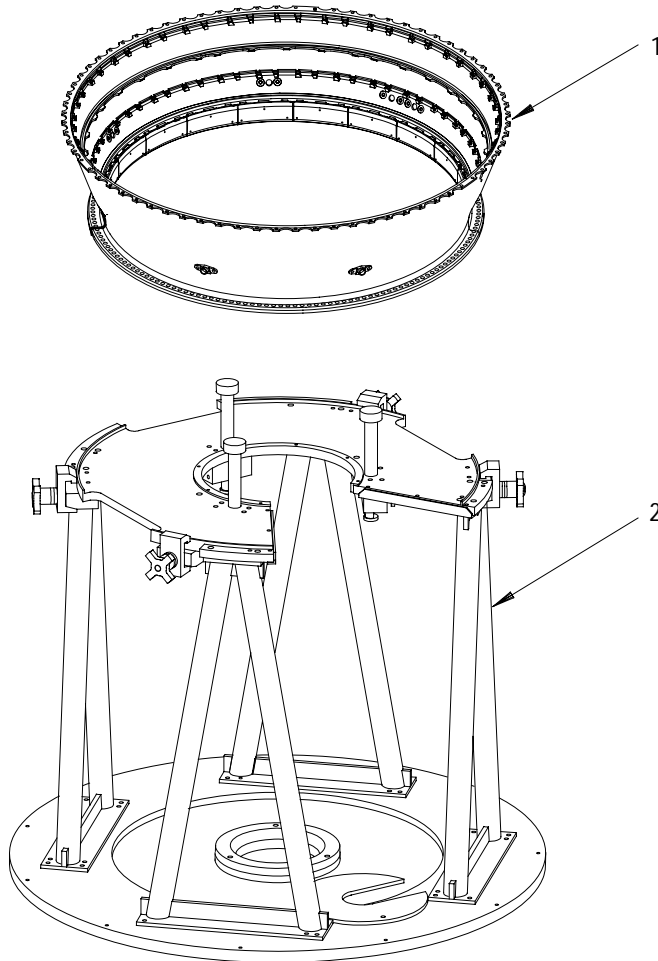
Figure 1B. PWA 57738 Boss Installation Fixture

**3. REAR TURBINE CASE AND DUCT SET -
INSTALLATION ONTO PWA 57818 ADAPTER.**

(See Figure 2.)

- a. Ensure LM 1021 clamps are installed to prevent duct support and segments from falling out of case.

- b. Raise rear turbine case and duct set(1, figure 2) and install on PWA 57818 adapter(2). Remove LM 1021 clamps before case is fully seated.



1. Rear turbine case and duct set
2. PWA 57818 adapter

Figure 2. Rear Turbine Case and Duct Set - Installation onto PWA 57818 Adapter

4. THIRD STAGE TURBINE STATOR ASSEMBLY - INSTALLATION.

(See Figure 3.)

- a. Install 3rd stage turbine stator assembly(2, figure 3) into turbine case and duct set(3), aligning borescope plug hole in No. 1 vane with corresponding hole in rear turbine case and duct set.
- b. Lower assembly into case so that front legs of vanes fit in channel inside case.
- c. Pull up on air sealing ring to ensure vanes are seated in channel.

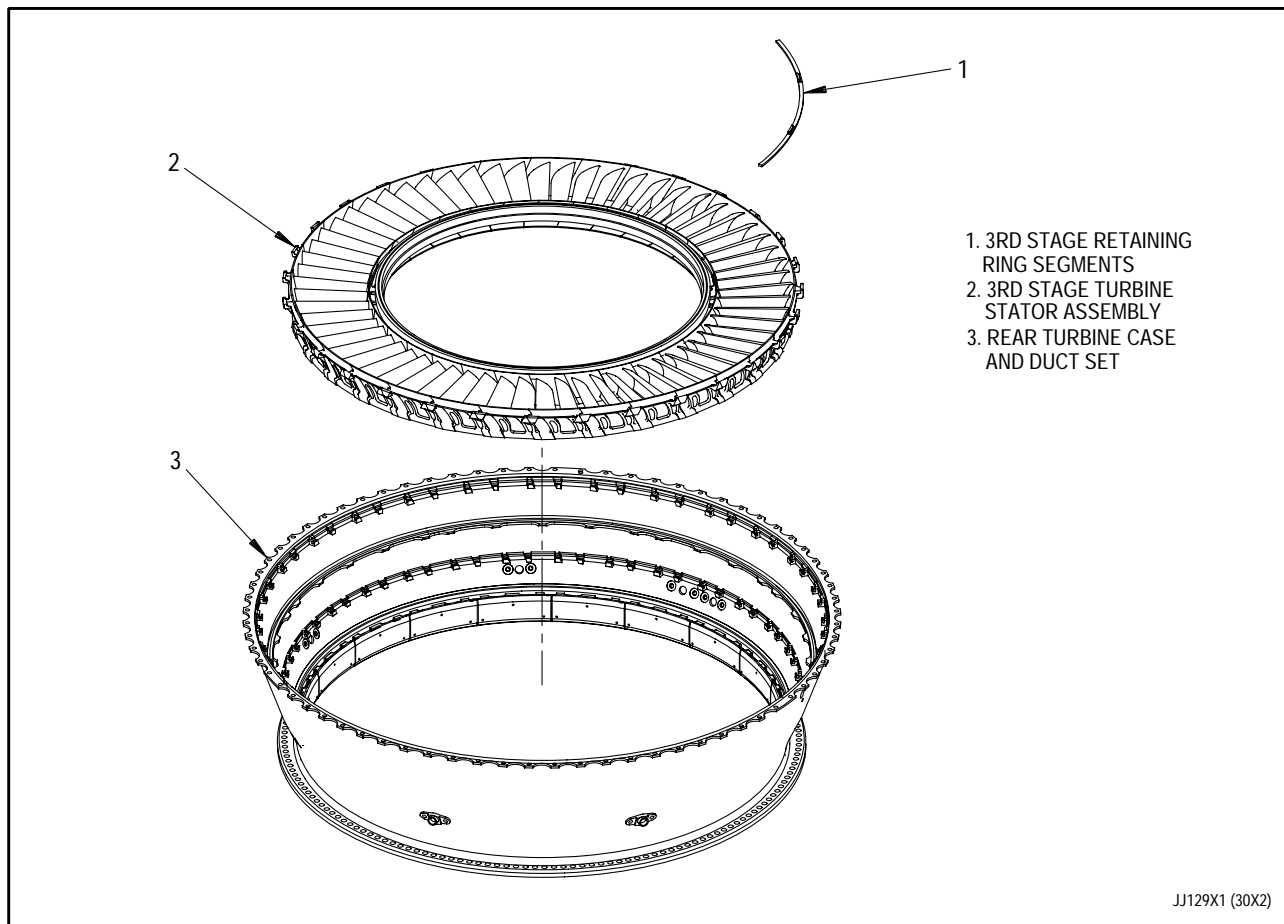


Figure 3. Third Stage Turbine Stator Assembly - Installation

NOTE

Vanes are fully seated when tip of vane feet are below retaining ring groove.

- d. Seat vanes by tapping vane feet with a nylon mallet.
- e. Install 3rd stage retaining ring segments(1) into groove in case and duct set in order marked at disassembly. Longest retaining ring segment is installed in borescope vane location.
- f. Check that vanes are in proper positions.
 - (1) Insert an FTIT thermocouple probe at each of seven locations on case and duct set to ensure vanes with thermocouple holes are in correct positions.
 - (2) Look through borescope plug hole to ensure borescope plug can be installed.

5. THIRD STAGE TURBINE AIR SEALING RING SEGMENTS (TIP SHROUD) - INSTALLATION.

(See Figure 4.)



Carefully install air sealing ring segments; segments can easily be damaged.

NOTE

The one shorter segment is installed over borescope hole.

- a. Install No. 1 3rd stage turbine air sealing ring segment(1, figure 4) at same location marked at disassembly. Put grooved end of segment down so that inner legs seat against 3rd stage turbine vanes and outer legs fit into groove inside rear turbine case and duct set(2).
- b. Assemble other segments around case at locations marked at disassembly.

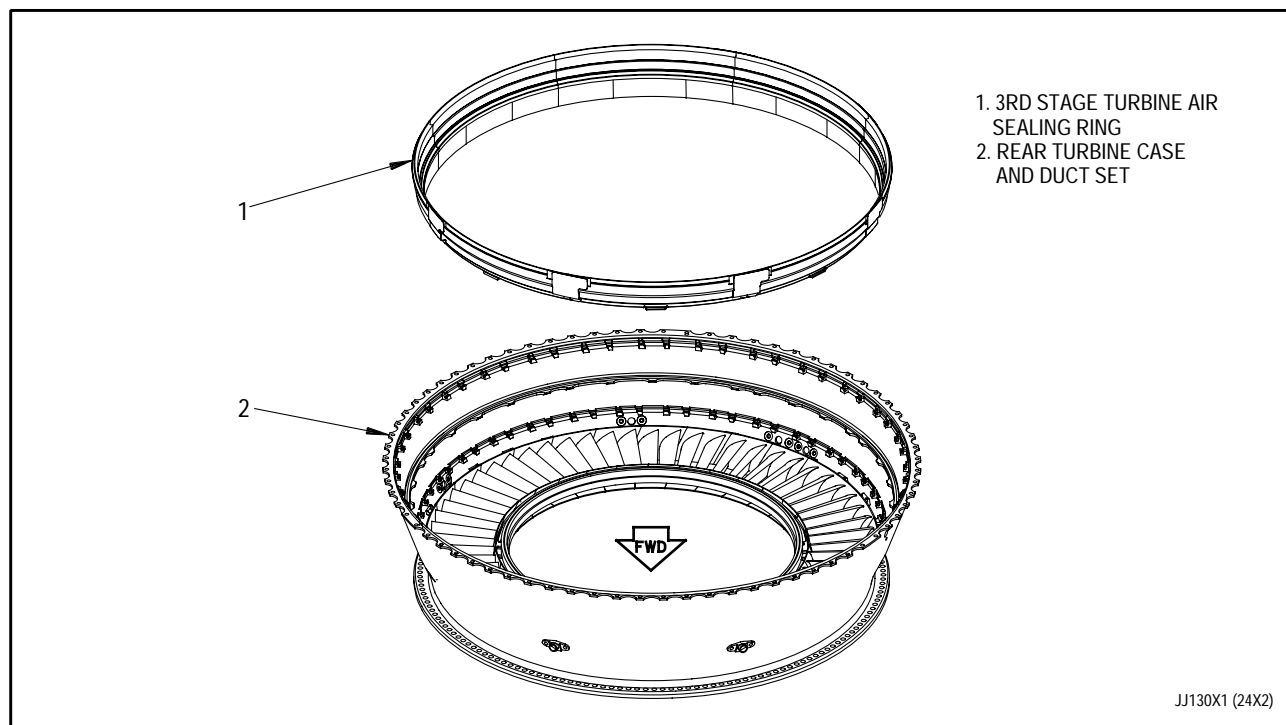


Figure 4. Third Stage Turbine Air Sealing Ring Segments - Installation

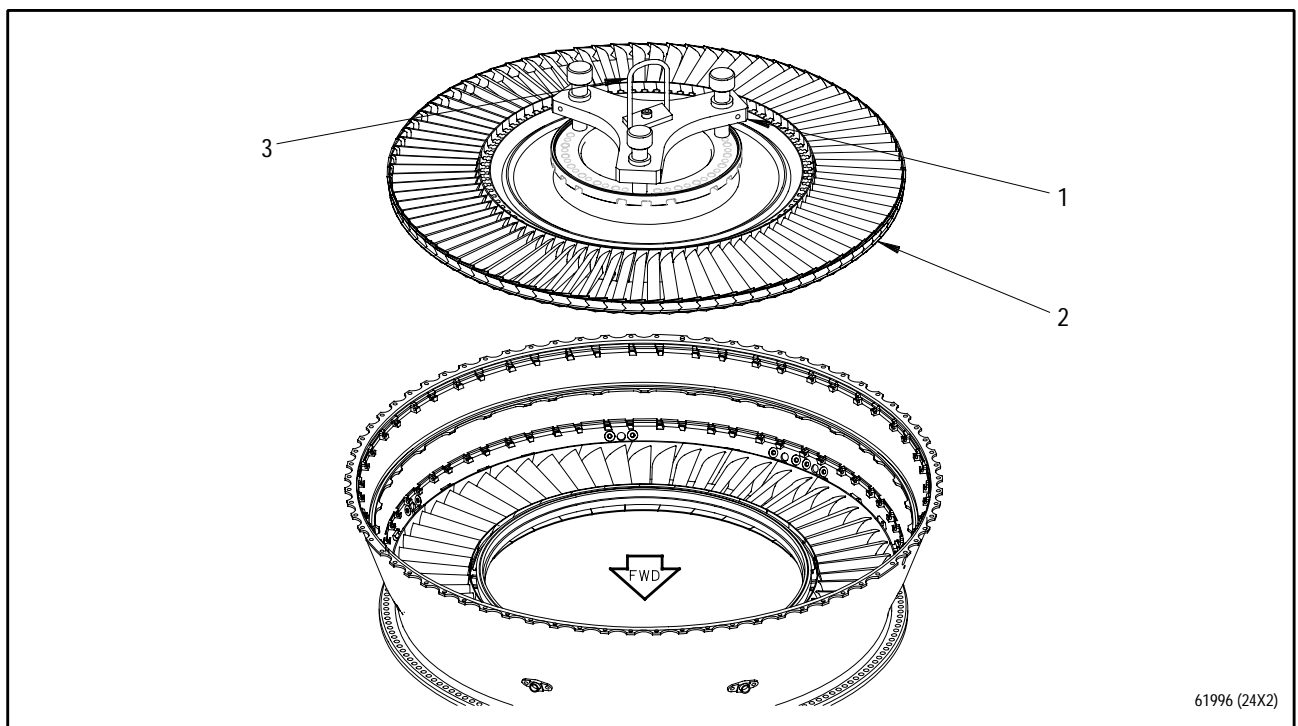
6. THIRD STAGE TURBINE DISK AND BLADES AND TURBINE REAR HUB ASSEMBLY - INSTALLATION.

(See Figures 5 and 6.)

NOTE

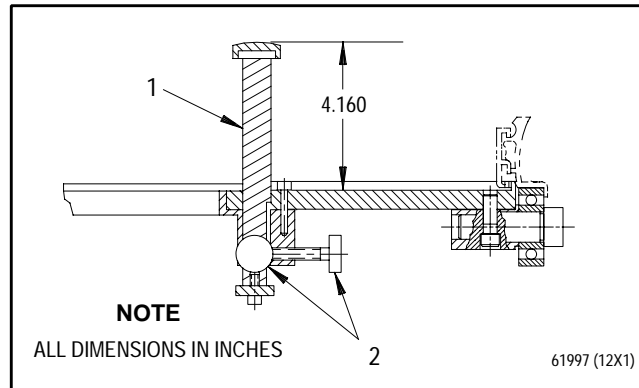
Support equipment identified as PWA 57653 detail-X in this WP are details of PWA 57810 tool set.

- a. Install PWA 57653 detail-7 lifting assembly(1, figure 5) on any three tierods at center of 3rd stage disk. Handtighten knob to secure lifting assembly(1).
- b. Connect an overhead hoist to lifting eye(3) of lifting assembly.
- c. Set height of PWA 57704 detail-51 jack assemblies(1, figure 6) (details of PWA 57818 adapter) to maintain axial position as follows:
 - (1) Loosen detail-7 knurled-head screws at each detail-51 jack assembly(1).
 - (2) Install detail-7 knurled-head screws(2) into threaded hole in detail-51 jack assembly(1) shaft, 3 places. This ensures preset height of 4.160 inches.



1. Lifting assembly
2. 3rd stage turbine disk and blades and rear turbine hub
3. Lifting eye

Figure 5. Third Stage Disk and Blades and Turbine Rear Hub Assembly - Installation



1. Jack assembly
2. Knurled head screws

Figure 6. Setting Axial Position on PWA 57818 Adapter

d. Raise 3rd stage disk and blades into position over case and duct set.



Use extreme care when lowering 3rd stage disk and blades into case and duct set to avoid damaging knife-edge seals and air sealing ring.

e. Carefully lower disk and blades onto detail-51 jack assemblies(1).

f. Remove PWA 57653 detail-7 lifting assembly.

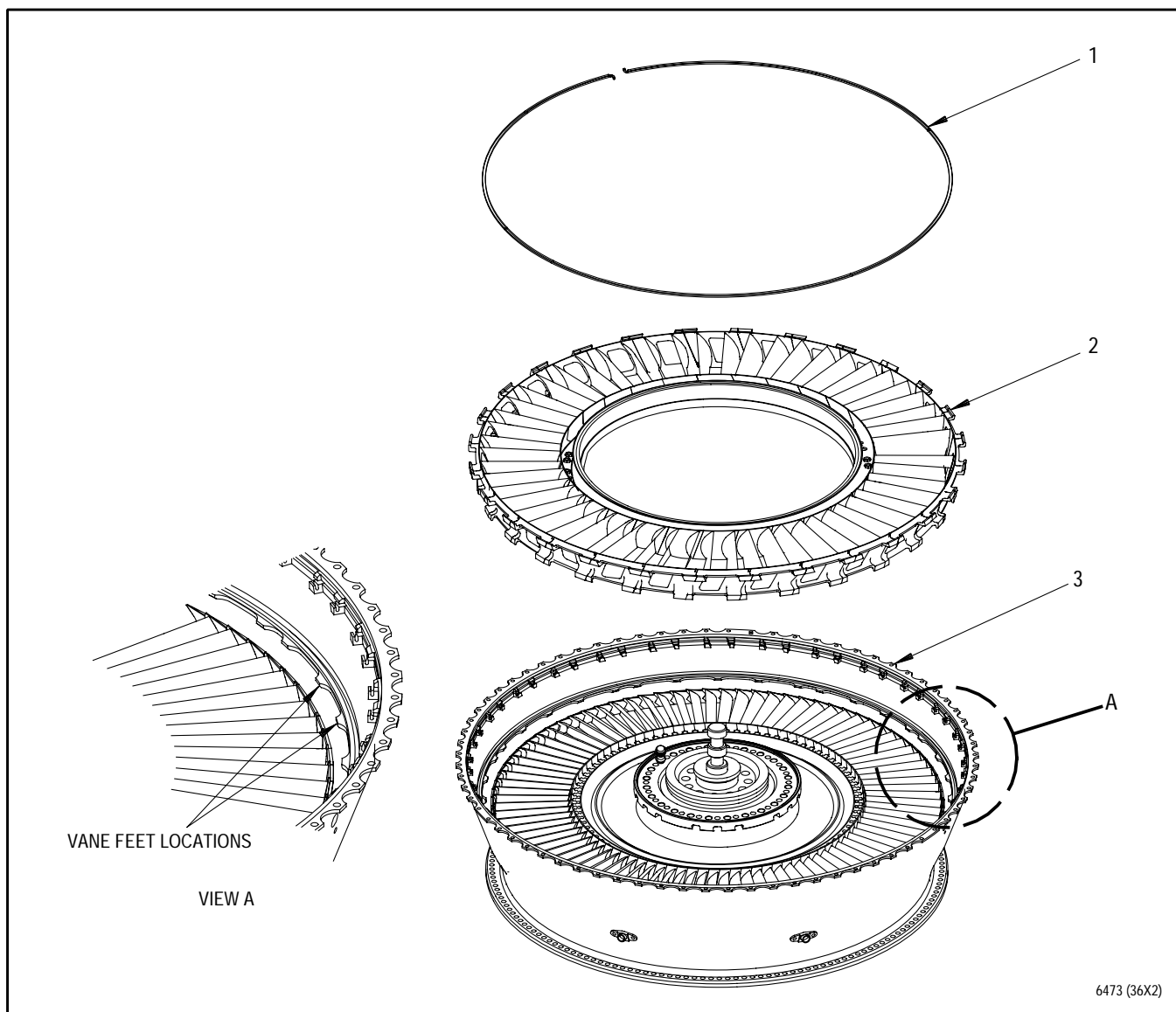
7. FOURTH STAGE TURBINE STATOR ASSEMBLY - INSTALLATION.

(See Figure 7.)

- a. Lower 4th stage turbine stator assembly(2, figure 7) into case and duct set(3).

NOTE

- Vanes are fully seated when edge of vane shrouds are below retaining ring groove.
 - To facilitate installation, lift up on 3rd stage turbine air sealing ring assembly when seating vanes.
- b. Seat vanes using a nylon mallet so front legs of each vane fit into groove in case and duct set.
 - c. Ensure vane feet are located at case tang areas.
 - d. Install 4th stage retaining ring(1) into groove in case and duct set(3).



1.4th stage retaining ring

2.4th stage turbine stator vane assembly

3.Rear turbine case and duct set

Figure 7. Fourth Stage Turbine Stator Assembly - Installation

Pages 25, 26 and figure 8 deleted.

8. Deleted.

8A. FOURTH STAGE TURBINE AIR SEALING RING SEGMENTS (14 SEGMENT CONFIGURATION TIP SHROUD) AND SUPPORT - INSTALLATION.

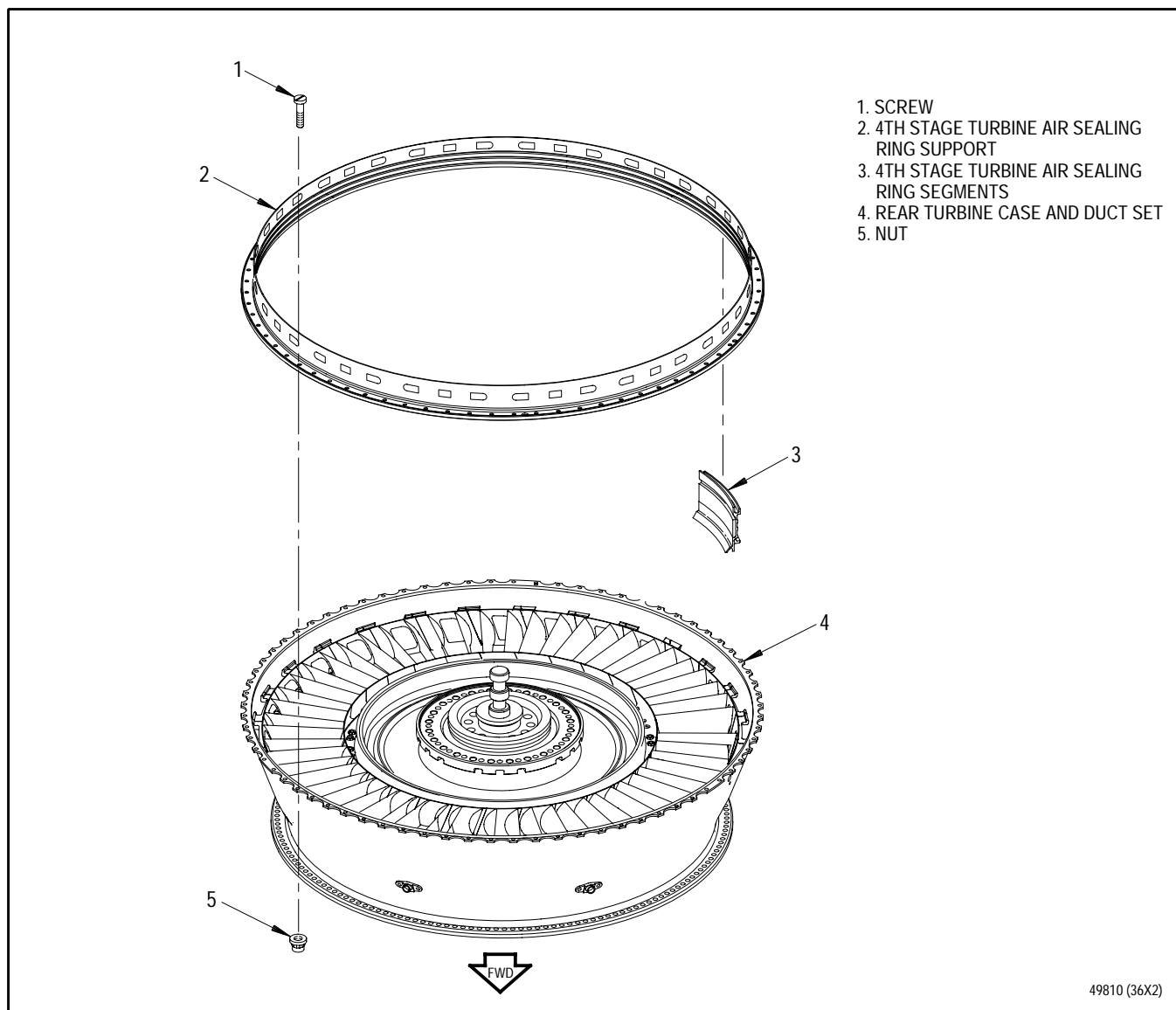
(See Figure 8A.)

NOTE

- If one or more segments require replacement, entire set shall be replaced.
 - Slots in support are arranged in groups of three with center slot narrower than two adjacent slots. Center hook on segment OD shall engage center slot of each group of three support slots.
- a. Install 4th stage turbine air sealing ring segments(3, figure 8A) into 4th stage turbine air sealing ring support(2) as follows:
- (1) Position segment inside support with three OD hooks facing rearward. Align center hook on segment with center slot of a group of three support slots.
 - (2) Tilt segment slightly toward center of support and engage three segment hooks into three support slots. Position segment OD outward against support ID and slide segment rearward by hand.
- (3) Repeat steps (1) and (2) until all segments are installed. If necessary, lightly tap adjacent segments circumferentially away from vacant area using hammer and brass or fiber drift to install last segment.
- (4) Seat segments rearward by tapping lightly with a soft-faced mallet.
- b. Install 4th stage turbine air sealing ring support and segment assembly on rear turbine case and duct set as follows:
- (1) Align dowel pin hole in support(2) with dowel pin in case and duct set(4).
 - (2) Lower support and segment assembly onto case(4). If necessary, heat case flange to 200°F (93°C) using heat gun detail of PWA 56326 heater. Use a standard 0° to 800°F pyrometer to measure temperature. Support flange should sit flush on case flange.
 - (3) Lubricate three screws(1) with Fel-Pro C-300 antigalling compound.
 - (4) Install screws(1) and nuts(5) to secure support assembly(2) to case(4).
 - (5) Tap around support assembly with a soft-faced mallet to ensure it is seated.
 - (6) Torque screws 24 to 32 pound-inches plus torque required to turn screw through nut.



Use drift only on solid metal area of segment to prevent damage to honeycomb area.



**Figure 8A. Fourth Stage Turbine Air Sealing Ring Segments
(14 Segment Configuration Tip Shroud) and Support - Installation**

9. FOURTH STAGE TURBINE AIR SEAL - INSTALLATION ONTO FOURTH STAGE TURBINE DISK AND BLADES.

(See Figure 9.)

- a. Install PWA 57653 detail-5 3rd stage pusher/support(2, figure 9) onto detail-8 support assembly(3). Secure with detail-8-2 quick-release pins(4).
- b. Deleted.
- c. Chill 4th stage turbine air seal(1) in freezer for 20 minutes.
- d. Install 4th stage turbine air seal(1) onto 4th stage disk and blades(5), aligning air seal as follows:
 - (1) For air seal with dowel pin, align pin with slot on disk fir tree.
 - (2) Deleted.
- e. Hold air seal(1) in place until parts cool to room temperature.
- f. Locate offset dowel pin hole (marked with an X) adjacent to tierod bolt holes in 4th stage disk and blades(5) and mark rear side of tierod flange for alignment at installation using Colorbrite No. 2101 silver pencil or equivalent.
- g. Remove 4th stage disk and blades(5) from PWA 57653 detail-5 3rd stage pusher/support(2) and place assembly on bench rear face up.
- h. Remove wire holding blades in place.

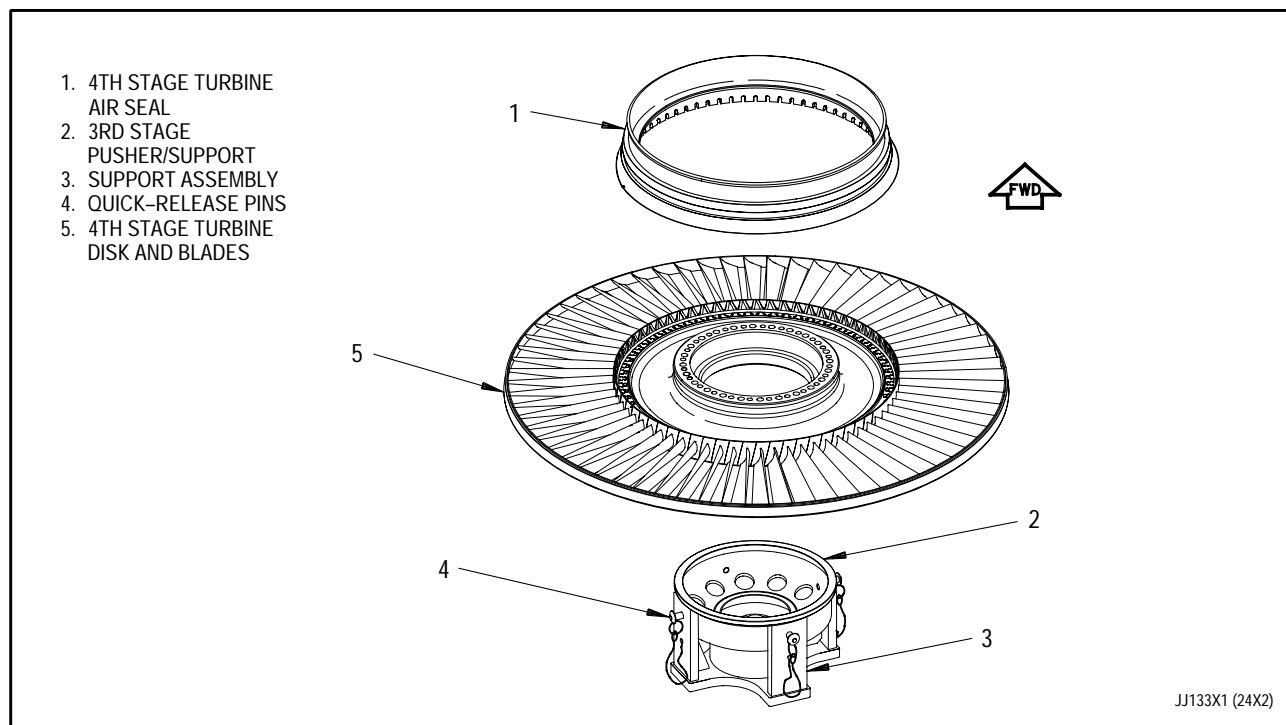


Figure 9. Fourth Stage Turbine Air Seal - Installation Onto Fourth Stage Turbine Disk and Blades

10. FOURTH STAGE TURBINE DISK, BLADES, AND AIR SEAL - INSTALLATION.

(See Figure 10.)

- a. Locate offset dowel pin (marked with an X) in turbine rear hub.
(See figure 10, sheet 1.)
- a1. For 60 blade 4th stage turbine disk do not install spacer on disk.
- b. Install PWA 57810 detail-4 4th stage puller assembly onto 4th stage disk and blades.
- c. Ensure alignment mark at offset dowel pin hole is visible through a slot in detail-4 4th stage puller assembly.
- d. Secure by depressing button and rotating handles outward until collars lock in place.

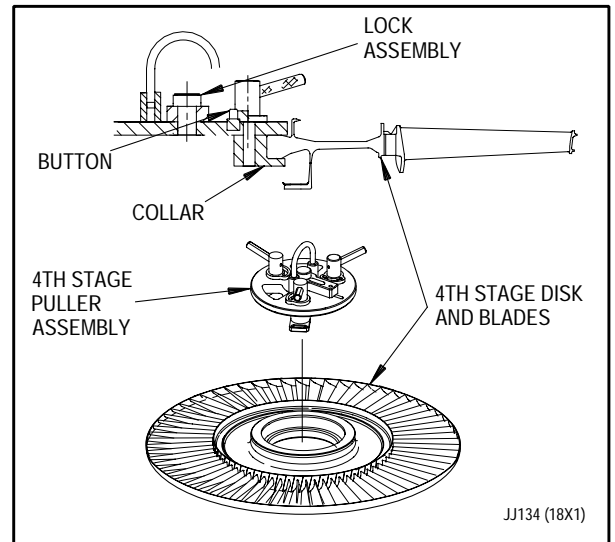


Figure 10. Fourth Stage Turbine Disk, Blades and Air Seal - Installation (Sheet 1 of 7)

- e. If necessary, install detail-1-2 hub adapter and hub adapter lock nut onto turbine rear hub. Secure hub adapter with hub adapter lock nut.
- f. Thread detail-2 or detail-11 cylinder assembly into detail-1-1 hub adapter assembly.
- f1. Apply PWA 36545-3 antigalling compound to 4th stage turbine disk and hub snap diameter. Remove excess antigalling compound.

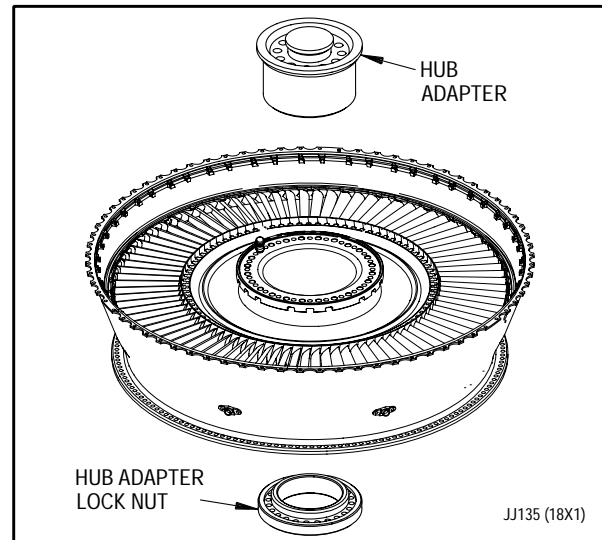


Figure 10. Fourth Stage Turbine Disk, Blades and Air Seal - Installation (Sheet 2 of 7)

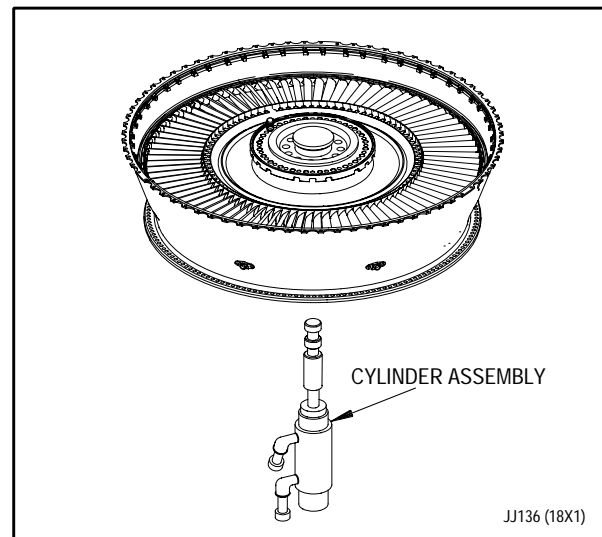


Figure 10. Fourth Stage Turbine Disk, Blades and Air Seal - Installation (Sheet 3 of 7)

- g. Install PWA 57886 heater on turbine rear hub. Ensure thermocouple probe contacts flange of hub. (See figure 10, Sheet 4.)
- h. Connect power receptacle and thermocouple to PWA 61685 heater control.
- i. Heat turbine rear hub at 230° to 250°F (110° to 121°C) for 30 minutes. Hub temperature shall be 175° to 200°F (79° to 93°C).
- j. Connect hoses of PWA 51946 pump to couplers on cylinder.
- k. Using an overhead hoist, position 4th stage disk and blades over turbine case. Allow clearance to remove heater.
- l. Turn off power. Remove heater.

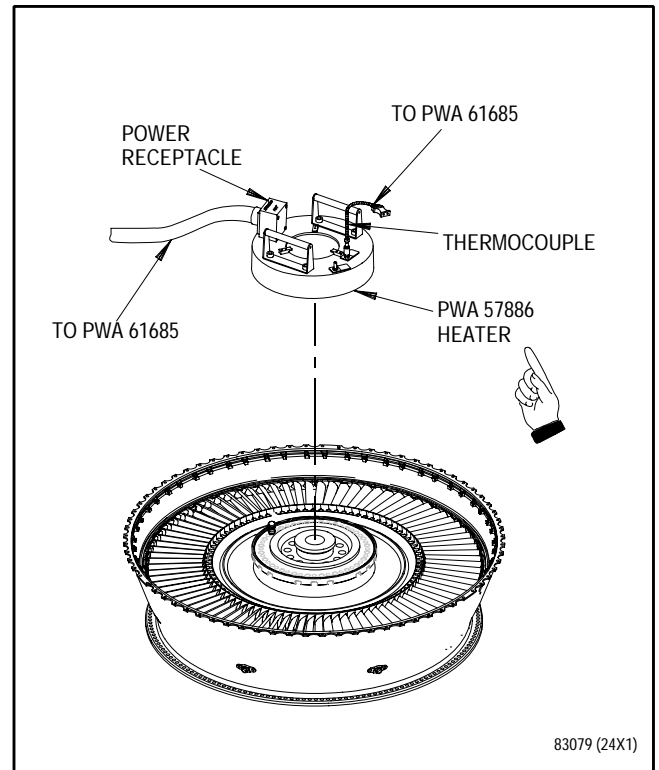


Figure 10. Fourth Stage Turbine Disk, Blades and Air Seal - Installation (Sheet 4 of 7)



Use extreme care when lowering 4th stage disk into case and duct set. Clearances are tight and damage to knife-edge seals and air sealing segments can result.

- m. Carefully lower 4th stage disk and blades onto turbine rear hub, aligning tierod holes and index mark at offset dowel pin and dowel pin hole. (See figure 10, Sheet 5.)

NOTE

It may be necessary to actuate pump to engage clamp around shaft of cylinder assembly.

- n. Push PWA 57810 detail-4 puller assembly detail-4-17 clamp inward to engage upper slot on shaft of cylinder.

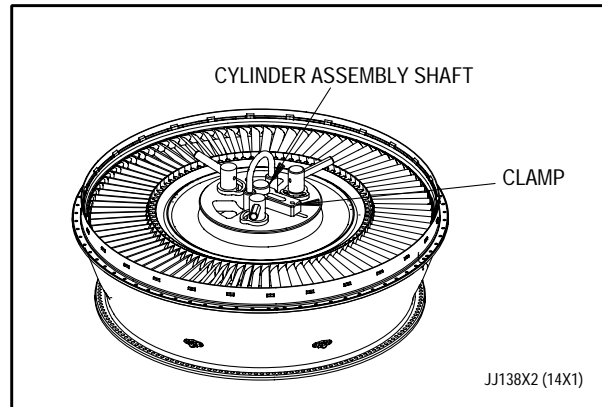


Figure 10. Fourth Stage Turbine Disk, Blades and Air Seal - Installation (Sheet 5 of 7)

- o. Actuate PWA 51946 pump to seat 4th stage disk, blades, and air seal.
- p. Verify 4th stage disk is seated on rear hub, by looking through cut outs in detail-4 puller assembly.
- q. Let parts cool to room temperature while maintaining pump pressure.
- r. Release pump pressure and remove tooling.
- s. Install new key washers with prebent tabs up and facing toward ID of assembly over tierods. (See figure 10, Sheet 6.)



If key washer face and tierod nut threads and washer face are not properly coated with antigalling compound, required torque may not be obtained.

- t. Ensure tierod nut threads, washer face, and key washer face are coated with PWA 36545-3 antigalling compound, baked on.
- u. Prior to reuse only, strip and recoat tierod nut threads and washer face with PWA 36545-3 antigalling compound. Nut run on torque shall not exceed 5 pound-inches.
- v. If necessary, burnish excess PWA 36545-3 antigalling compound from tierod nut threads using a medium brass brush. Take care not to expose parent metal.
- w. Install tierod nuts. Tighten nuts fingertight.

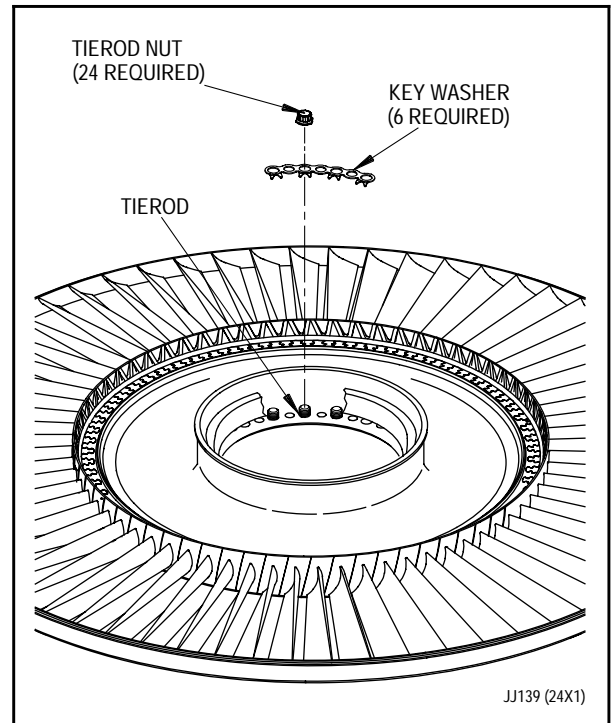


Figure 10. Fourth Stage Turbine Disk, Blades and Air Seal - Installation (Sheet 6 of 7)

- x. Install PWA 57809 adapter as follows: (See figure 10, Sheet 7.)
- (1) Install PWA 57809 detail-12 spacer onto detail-5 locator ring with nylon screws.
- (1a) Install detail-5 locator ring onto 4th stage disk.
- (2) Align No. 1 position on detail-5 locator ring with No. 1 blade slot on 4th stage turbine disk at 12 o'clock position, indicated by X marks on disk fir trees adjacent to No. 1 blade slot.
- (3) Deleted.
- (4) Secure detail-5 locator ring with three detail-6 clamps, bevel end up, evenly spaced. Use three detail-3 cap screws to secure detail-6 clamps.

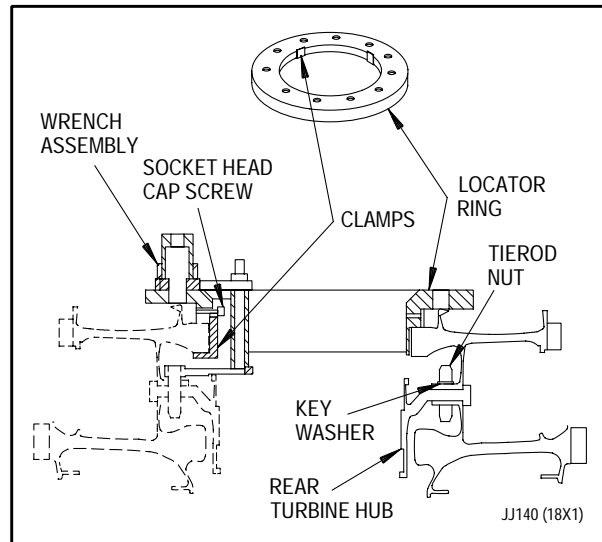


Figure 10. Fourth Stage Turbine Disk, Blades and Air Seal - Installation (Sheet 7 of 7)

y. Torque tierod nuts as follows:

- (1) Torque tierod nuts 70 to 80 pound-inches per sequence shown on detail-5 locator ring.
- (2) Further torque tierod nuts 140 to 150 pound-inches per sequence shown on detail-5 locator ring.
- (3) Continue torquing per sequence shown on detail-5 locator ring until 140 to 150 pound-inches is maintained.
- (4) Loosen No. 1 tierod nut to 0 torque, while maintaining torque on all other tierod nuts.
- (5) Torque No. 1 tierod nut 36 to 42 pound-inches.
- (6) Line up 0 degree mark on scale of detail-8 wrench assembly with line adjacent to sequence number marked on detail-5 locator ring. Tighten thumbscrew to secure scale.
- (7) Apply angle of turn of 54 to 58 degrees.
- (8) Ensure tierod nut has minimum preload torque of 130 pound-inches.
- (9) Repeat steps (4) through (8) for No. 2 tierod nut.
- (10) Check torque of 140 to 150 pound-inches on tierod nuts No. 17, 18, 21 and 22. No additional torque shall be added.
- (11) If tierod nuts No. 17, 18, 21, and 22 are within limits, proceed to step (14).
- (12) Torque tierod nuts No. 3 through No. 24 140 to 150 pound-inches.
- (13) Repeat steps (10) through (12) as required.
- (14) Loosen No. 3 tierod nut to 0 torque, while maintaining torque on all other tierod nuts.
- (15) Torque No. 3 tierod nut 36 to 42 pound-inches.
- (16) Line up 0 degree mark on scale of detail-8 wrench assembly with line adjacent to sequence number marked on detail-5 locator ring. Tighten thumbscrew to secure scale.
- (17) Apply angle of turn of 54 to 58 degrees.
- (18) Ensure tierod nut has minimum preload torque of 130 pound-inches.
- (19) Repeat steps (14) through (18) for tierod nuts No. 4 through No. 24.
- (20) Check tierods No. 1 through No. 24 in sequence for minimum preload torque of 130 pound-inches.

- z. Verify 4th stage turbine disk is seated by attempting to insert a 0.001 inch feeler gage between flanges of 4th stage turbine disk and turbine rear hub. If feeler gage cannot be inserted at four equally spaced locations, disk is fully seated.
- aa. Remove detail-5 locator ring.
- ab. Bend tab of key washers:
 - (1) Place tip of PWA 52556 crimper against key washer.
 - (2) Tap crimper with a mallet to bend key washer tabs against nuts.

11. FRONT COMPRESSOR DRIVE TURBINE SHAFT ASSEMBLY - INSTALLATION INTO TURBINE REAR HUB.

(See Figures 11 through 13 and Table 1.)

- a. Heat ID of turbine rear hub to 380° to 400°F (193° to 204°C) for 30 minutes. Use PWA 56326 heater and a standard 0° to 800°F pyrometer to measure hub temperature.
- b. Deleted.

NOTE

It is permissible to raise shaft with PWA 57812 pusher. Install pusher per step f.

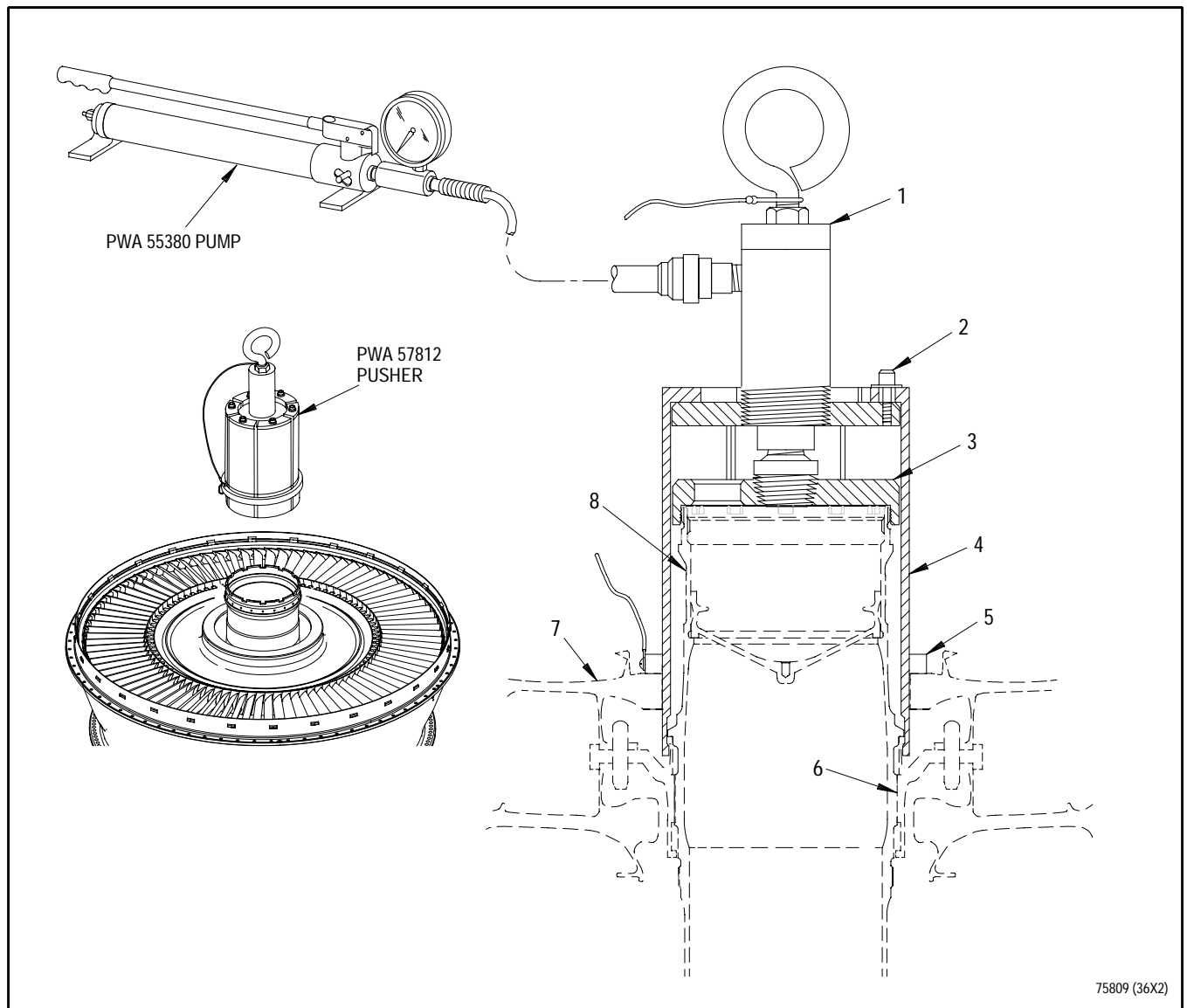
- c. Install PWA 51026 lifting eye on end of turbine shaft. Connect to an overhead hoist and raise shaft into position over rotor and stator.

- d. Remove PWA 56326 heater.
- e. Carefully lower turbine shaft down into turbine rear hub so splines engage. Ensure two corresponding master splines (two widest splines 180 degrees plus one tooth apart) on shaft and hub are aligned. Remove PWA 51026 lifting eye.

NOTE

Only three jaws(4, figure 11) are used with PWA 57812 pusher.

- f. Install PWA 57812 pusher as follows:
 - (1) Thread plate(3, figure 11) onto turbine shaft(8).
 - (2) Engage three jaws(4) under rear flange of turbine rear hub(6).
 - (3) Tighten cap screws(2) and slide ring(5) down to secure jaws in position.
 - (4) Connect hose of PWA 55380 pump to coupler on ram(1).



1. Ram
2. Cap screw
3. Plate
4. Jaw
5. Ring
6. Turbine rear hub
7. 4th stage disk
8. Turbine shaft

Figure 11. Front Compressor Drive Turbine Shaft - Seating with PWA 57812 Pusher

WARNING

Exceeding pressure specified may cause tool to fail, resulting in personal injury.

- g. Seat turbine shaft by working hand pump until seating shoulder on turbine shaft is flush against turbine rear hub. Do not exceed maximum pressure specified in table 1.

- h. Remove tooling and let parts cool to room temperature.
- i. Check that shaft is seated as follows:

NOTE

Measurements A and B shall be taken in line with 2 master splines.

- (1) Measure dimension A, distance from rear of turbine shaft to rear bore face of 4th stage turbine disk. (See figure 12.)

Table 1. Maximum Turbine Shaft Seating Pressures

PWA NO.	TOOL NAME	PWA HYDRAULIC PUMP GAGE READING
PWA 57753	Pusher, Hydraulic - Fan Drive Turbine (Assembly)	6000 PSIG - Maximum Turbine Shaft Seating Pressure
PWA 57812	Pusher, Hydraulic - Fan Drive Turbine (Assembly)	6000 PSIG - Maximum Turbine Shaft Seating Pressure

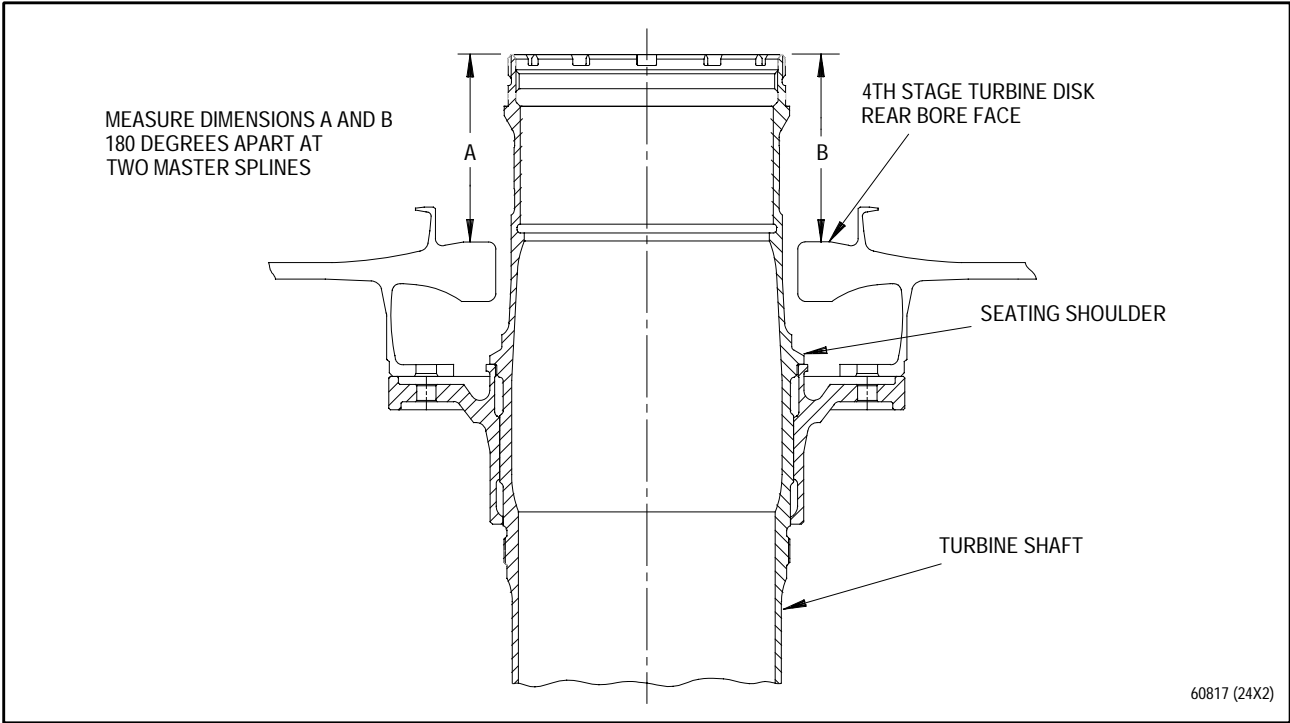


Figure 12. Front Compressor Drive Turbine Shaft - Measurement After Seating

- (2) Measure dimension B, 180 degrees from dimension A. Dimensions A and B shall be 3.991 to 4.023 inches for 60 blade turbine disk.
 - (3) Compare dimensions A and B, the difference between dimensions A and B shall not exceed 0.002 inch.
- j. If dimensions required are not met, turbine shaft is not seated. If shaft is not seated remove and inspect it as follows:
- (1) Remove turbine shaft. Refer to WP 021 00.
 - (2) Inspect Area E on turbine rear hub and Area F on turbine shaft for burrs and foreign material. (See figure 13.)
 - (3) Inspect Area G to ensure hub did not get caught there, keeping it from seating.
 - (4) Wipe Areas E, F, and G clean with a small amount of acetone and a clean cloth (see figure 13).
 - (5) Install turbine shaft per this paragraph.

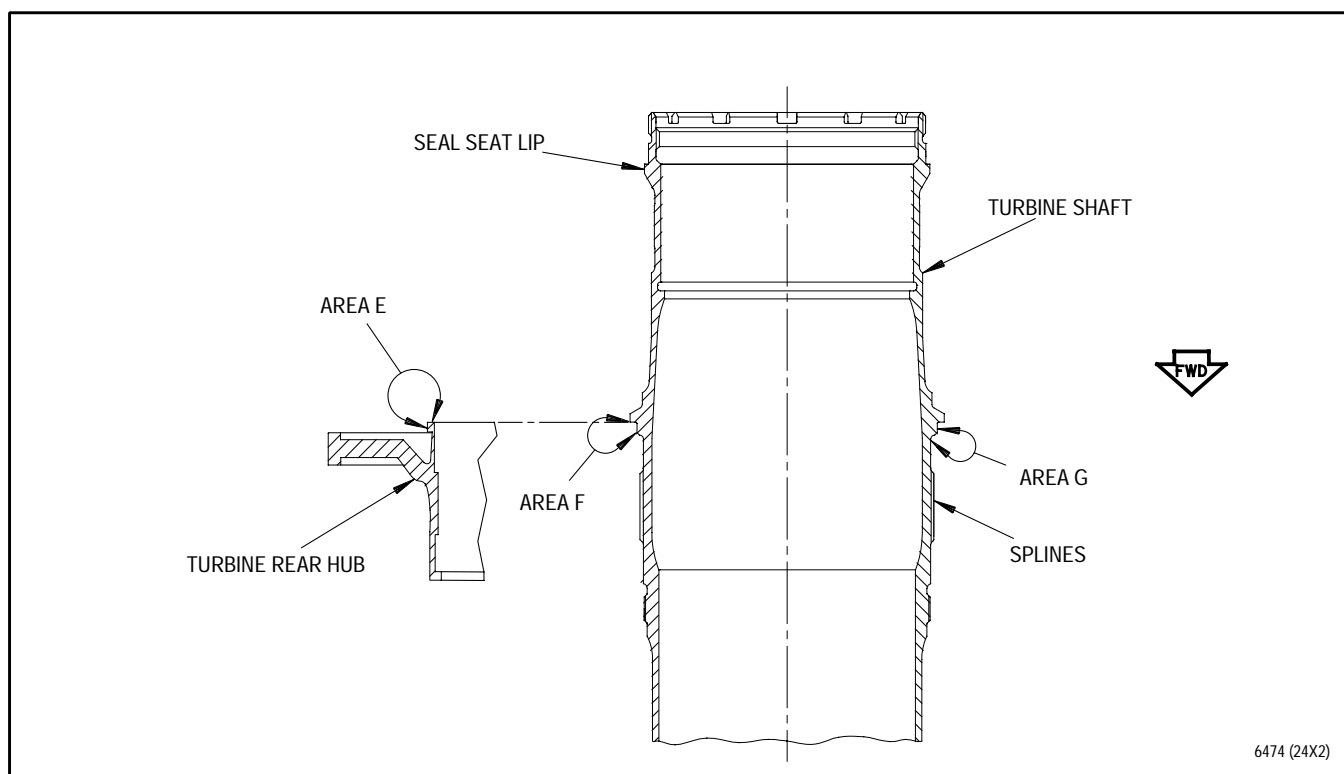


Figure 13. Front Compressor Drive Turbine Shaft and Turbine Rear Hub - Inspection Areas

11A. NO. 5 BEARING HEAT SHIELD AND BEARING PLUG - INSTALLATION.

(See figures 13 and Figure 14.)

a. Install No. 5 bearing heat shield(2, figure 14) as follows:

- (1) Dismantle PWA 51059 pusher into inner detail with ram and outer frame.
- (2) Install ram package of PWA 51059 pusher into shaft by engaging No. 5 bearing outer face nut threads in shaft and turning in counterclockwise direction. Shaft has a left-hand thread.
- (3) Place heat shield in oven and heat to maximum temperature of 200°F (93.3°C).
- (4) Install heated heat shield on shaft OD.
- (5) Attach PWA 55380 pump to pusher.
- (6) Position pusher frame on shaft so supply hose of ram is in groove of pusher frame, spin down nut.

(7) Actuate ram to seat heat shield, do not exceed 2700 psig.

(8) Remove pusher after heat shield has seized to shaft.

(9) Ensure aft end of heat shield is flush or below forward seal seat lip on turbine shaft (See figure 13).

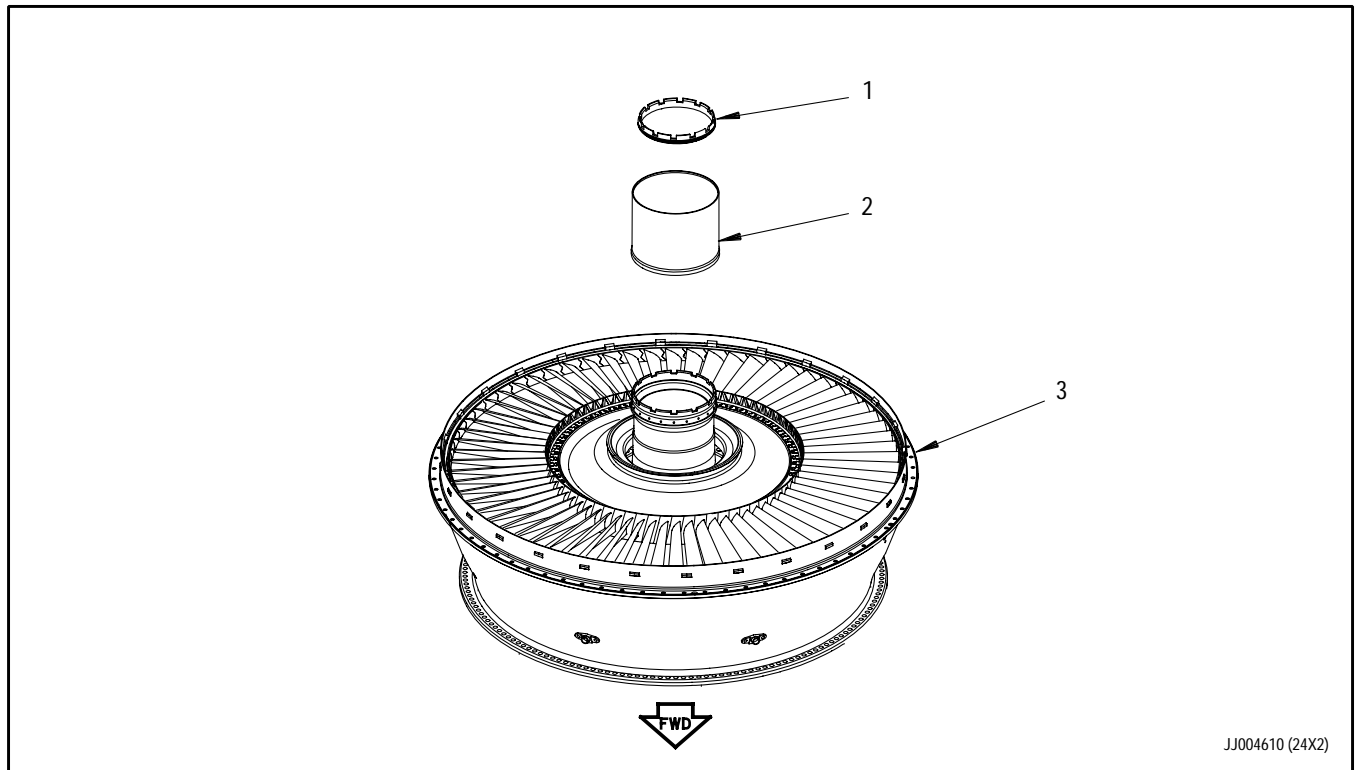
b. Install No. 5 Bearing plug(1, figure 14) as follows:

(1) Chill No. 5 bearing plug.

(2) Insert PWA 51932 heater into turbine shaft rear ID.

(3) Screw clamp assembly onto OD thread of shaft.

(4) Set heater at 300°F to 149°C) maximum and heat 30 to 45 minutes.



JJ004610 (24X2)

1. No. 5 bearing plug
2. No. 5 bearing heat shield
3. Turbine rotor and stator assembly

Figure 14. No. 5 Bearing Plug and Heat Shield - Installation

- (5) Use standard pyrometer 0° to 800°F (-18° to 427°C) in order to monitor temperature.
- (6) Retract pusher stud of PWA 51049 pusher.
- (7) Position No. 5 bearing plug within shaft.
- (8) Thread pusher onto OD of shaft.
- (9) Use wrenching action to seat No. 5 bearing plug.
- (10) Remove pusher.

**12. FRONT COMPRESSOR DRIVE TURBINE
ROTOR AND STATOR - INSTALLATION INTO
PWA 56338 STAND FOR FRONT COMPRESSOR
DRIVE TURBINE SHAFT NUT INSTALLATION.**

(See Figure 15.)

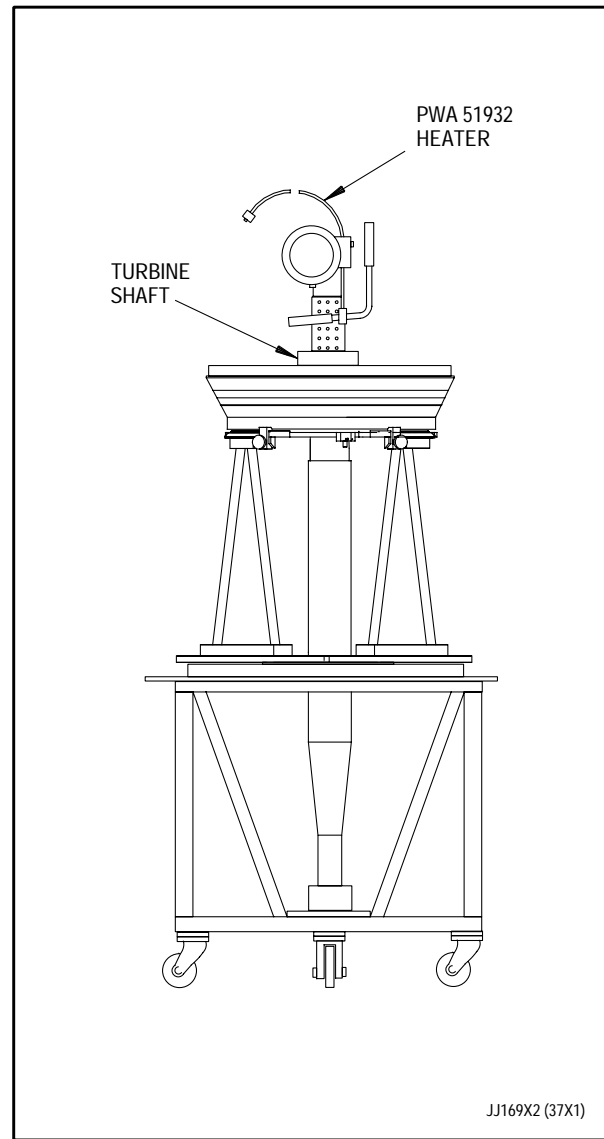
NOTE

Steps a. and b. shall be performed in rapid succession to minimize heat loss.

a. Install PWA 56729 spacer in ID of front compressor drive turbine shaft as follows: (See figure 15, Sheet 1).

(1) Install PWA 51932 heater in rear ID of turbine shaft.

(2) Connect PWA 51932 heater to PWA 25672 control. Heat turbine shaft ID to 300°F (149°C) maximum for 30 to 45 minutes.



**Figure 15. Front Compressor Drive Turbine
Rotor and Stator - Installation into PWA 56338
Stand (Sheet 1 of 9)**

(3) Position PWA 56729 spacer in rear ID of turbine shaft.

- b. Install PWA 51046 balance bearing assembly as follows:
(See figure 15, Sheet 2.)



- To prevent inaccurate balancing results, ensure balance bearings have been properly inspected before installation. Refer to T.O. 2-1-111.
 - Failure to wear clean synthetic rubber or lint free nylon mesh gloves when handling bearings can cause damage to part.
- (1) Position bearing assembly in rear ID of turbine shaft.
 - (2) Thread PWA 51049 pusher on OD of turbine shaft. Use wrenching action to seat bearing assembly and spacer.
 - (3) Allow assembly temperature to normalize; then remove PWA 51049 pusher.

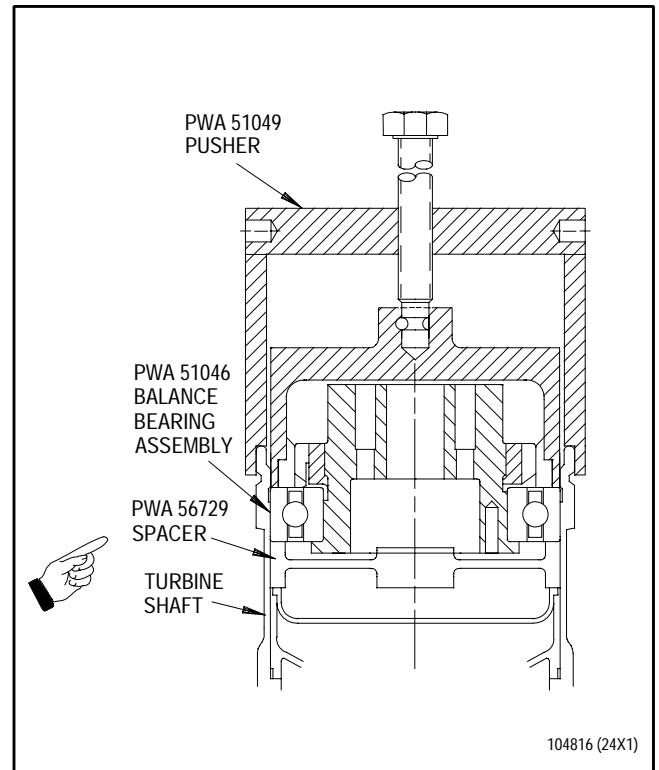


Figure 15. Front Compressor Drive Turbine Rotor and Stator - Installation into PWA 56338 Stand (Sheet 2 of 9)

- (4) Check squareness of rear face of PWA 51046 balance bearing assembly outer race using a vernier depth micrometer. (See figure 15, Sheet 3.) Take measurement at four equally spaced locations. Bearing outer race shall be square within 0.0005 inch. If bearing assembly is not properly seated, remove and reinstall balance bearing assembly.

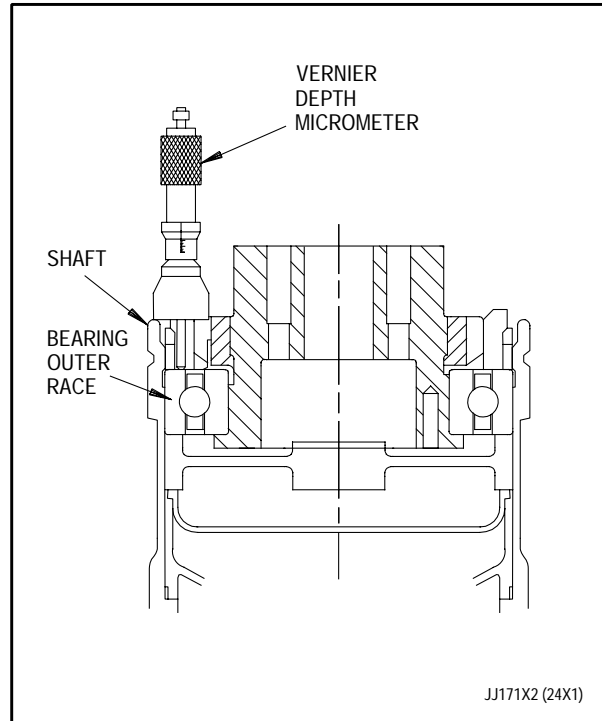


Figure 15. Front Compressor Drive Turbine Rotor and Stator - Installation into PWA 56338 Stand (Sheet 3 of 9)

NOTE

Hydraulic wrenches are not required in balance area unless optional wrench is used. PWA 51048 wrench and PWA 51051 holder are intended to be hand applied.

- (5) Secure outer race of bearing with PN 4001681 nut. (See figure 15, Sheet 4.)

NOTE

SAALC 8750370, PWA 50308 and PWA 51960 can be used in place of PWA 51048 and 51051 (see step (7) for option).

- (6) Tighten nut counterclockwise using PWA 51048 wrench and PWA 51051 holder.
- (7) Install SAALC X 8750370 wrench, PWA 51960 adapter and PWA 50308 hydraulic wrench.
- (8) Torque nut 1500 to 2000 pound-inches. Remove tooling.

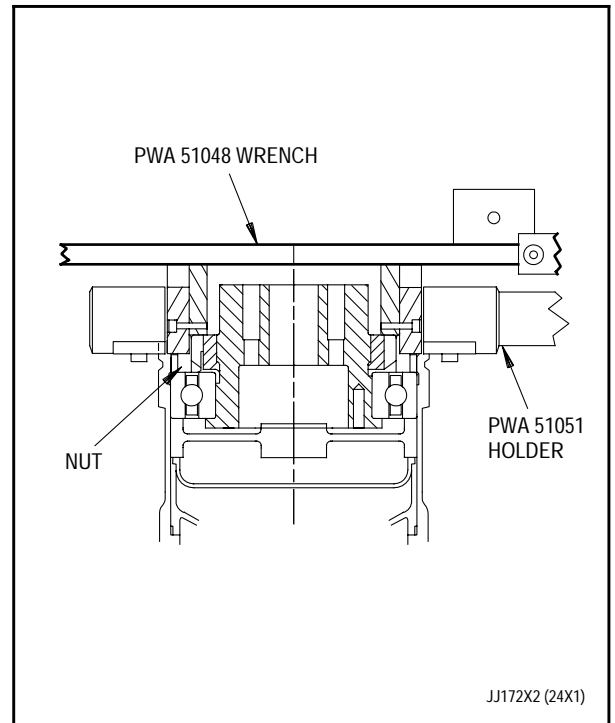


Figure 15. Front Compressor Drive Turbine Rotor and Stator - Installation into PWA 56338 Stand (Sheet 4 of 9)

- c. Install PWA 57715 rear balance fixture as follows:
(See figure 15, Sheet 5.)
 - (1) Visually verify that balance bearing assembly and balance fixture contact surfaces are clean and free of foreign material.
 - (2) Position PWA 57715 rear balance fixture using PWA 6580 sling, PWA 26147 adapters, and an overhead hoist. Ensure proper alignment of central hub of bearing assembly and rear balance fixture, and x-marked at 6 o'clock position of rear balance fixture with dowel pin at 6 o'clock position of turbine case.
 - (3) Tighten four cap screws to secure ID of balance fixture to PWA 51046 balance bearing.
 - (4) Secure PWA 57715 rear balance fixture to rear turbine case with 24 bolts.
 - (5) Handtighten three PWA 57715 detail-9 knurled head screws to secure fiber ring against turbine shaft.

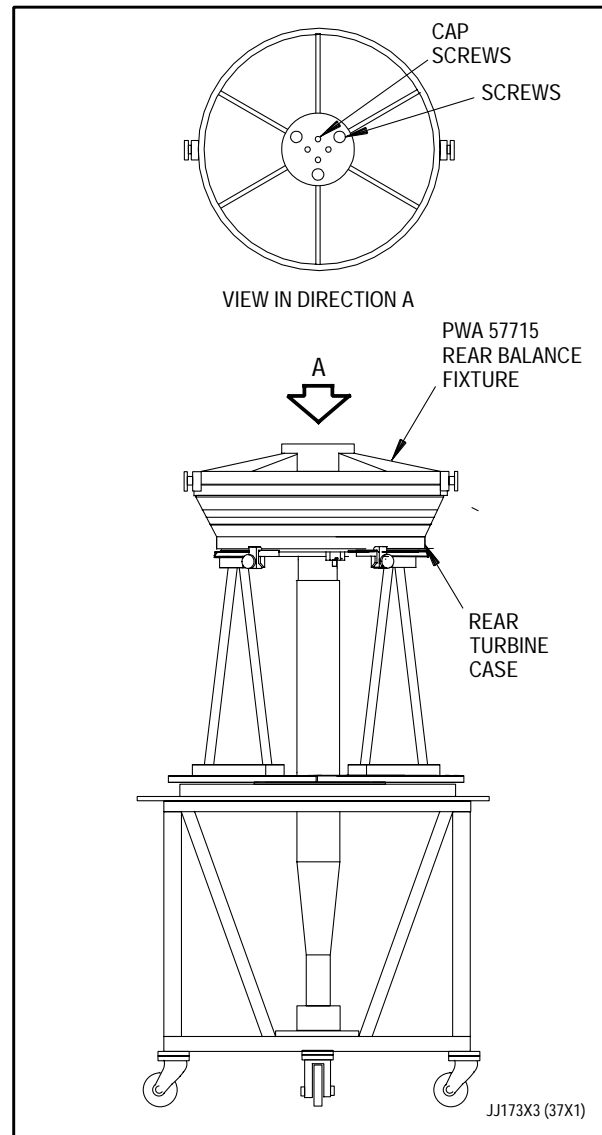


Figure 15. Front Compressor Drive Turbine Rotor and Stator - Installation into PWA 56338 Stand (Sheet 5 of 9)

d. Remove front compressor drive turbine rotor and stator assembly from PWA 57818 adapter as follows:

- (1) Install PWA 6580 sling onto overhead hoist.
- (2) Install PWA 26147 adapters onto PWA 6580 sling.
- (3) Attach PWA 26147 adapters to PWA 57715 balance fixture trunnions.



Second stage turbine support and duct set is loose fit inside rear turbine case and will be damaged if allowed to fall from case during handling.

- (4) Carefully lift rotor and stator assembly until forward flange of turbine case is several inches above flange of build stand. Ensure second stage support and duct set is still installed in turbine case. Install two LM 1021 clamps 180 degrees apart to hold support in place.
- (5) Raise module from build stand.
- (6) Install PWA 57819 retainer to front flange of turbine case. Ensure pusher detail-17 lock tabs engage shaft clamp toggle handles. Remove two LM 1021 clamps.

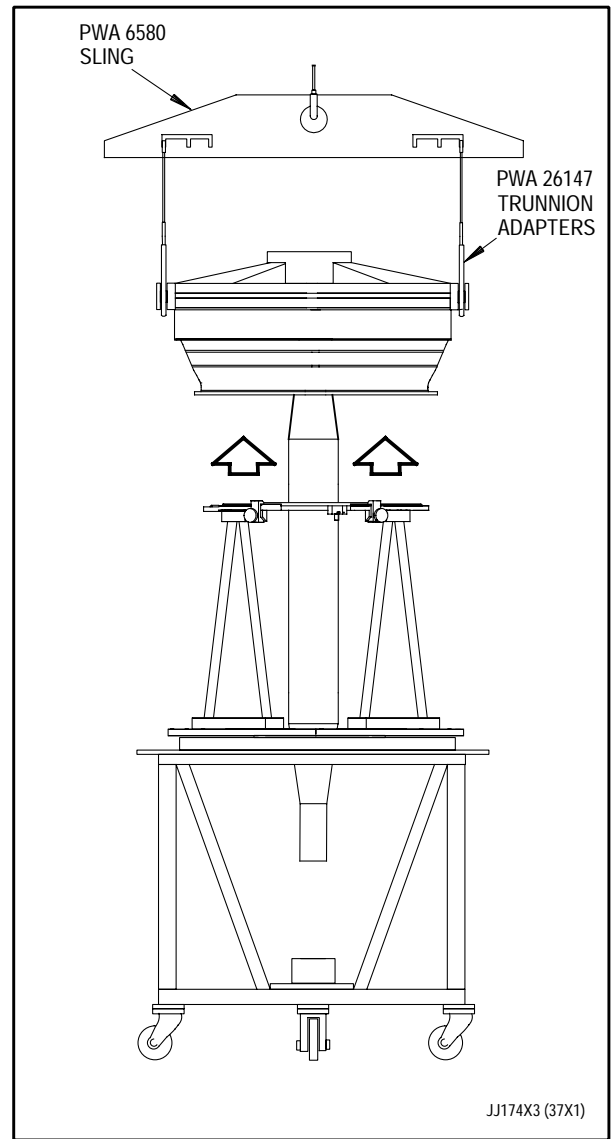


Figure 15. Front Compressor Drive Turbine Rotor and Stator - Installation into PWA 56338 Stand (Sheet 6 of 9)

- e. Install PWA 57839 adapter onto PWA 50775 stand and secure if PWA 56338 stand is not to be used.

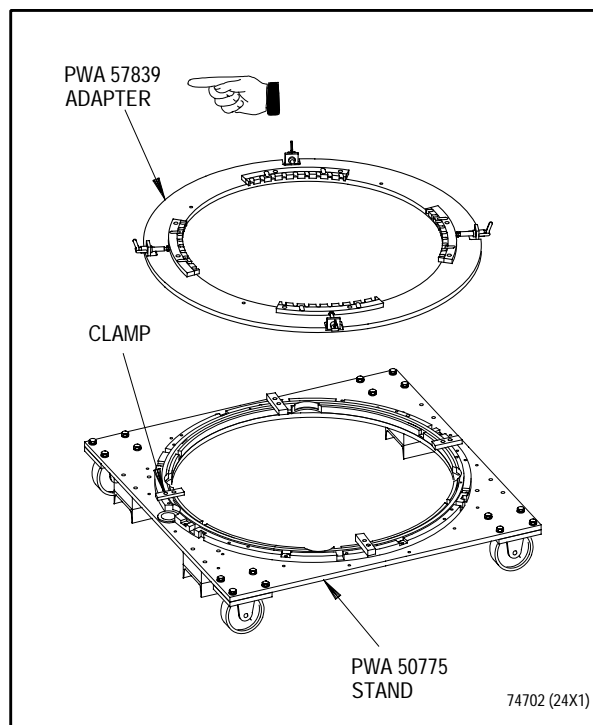


Figure 15. Front Compressor Drive Turbine Rotor and Stator - Installation into PWA 56338 Stand (Sheet 7 of 9)

f. Install rotor and stator assembly into PWA 56338 stand or PWA 57839 adapter and PWA 50775 stand as follows:
(See figure 15, Sheet 8.)

- (1) Install PWA 51056 lifting eye in front end of turbine shaft.
- (2) Attach overhead hoist to PWA 51056 lifting eye and rotate rotor and stator assembly to vertical shaft up position.
- (3) Remove PWA 6580 sling and PWA 26147 adapters from trunnions of PWA 57715 balance fixture.
- (3a) Ensure that flat side of detail-33 ring on PWA 56338 stand is facing up.
- (4) Lower rotor and stator assembly onto PWA 56338 stand or PWA 57839 adapter and PWA 50775 stand.
- (5) Secure assembly with four strap details.

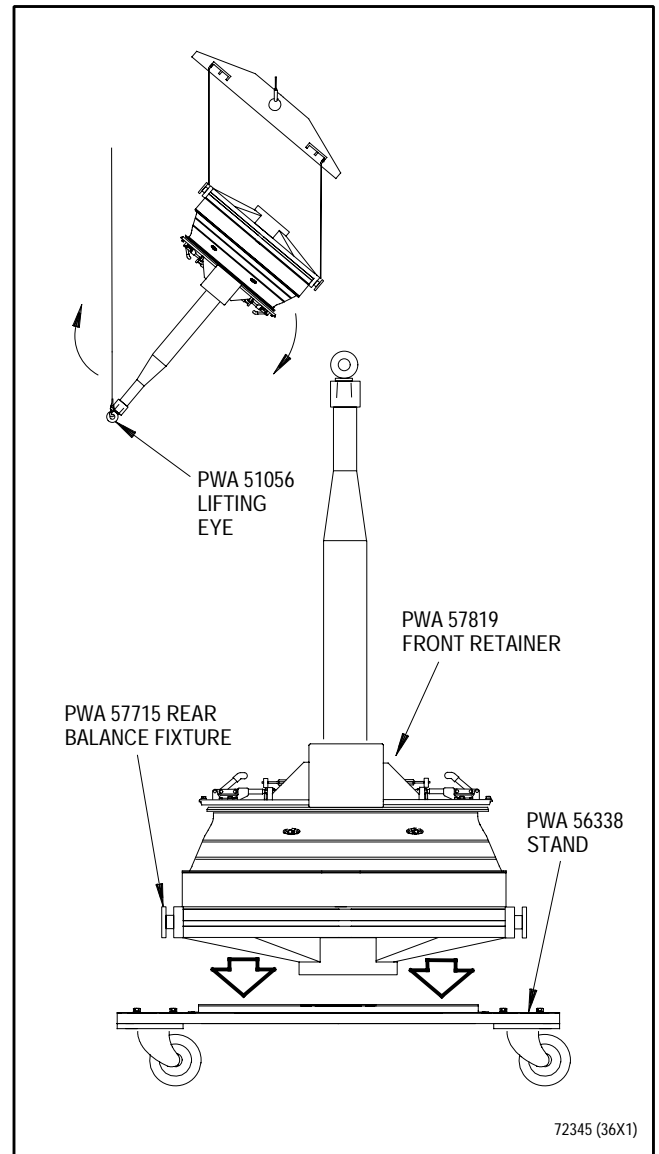


Figure 15. Front Compressor Drive Turbine Rotor and Stator - Installation into PWA 56338 Stand (Sheet 8 of 9)

- g. Remove PWA 57819 retainer as follows:
- (1) Remove PWA 51056 lifting eye.
 - (2) Unlock toggle clamps securing PWA 57819 retainer.
 - (3) Remove retainer.
 - (4) Install protective cover over front of rotor and stator assembly.

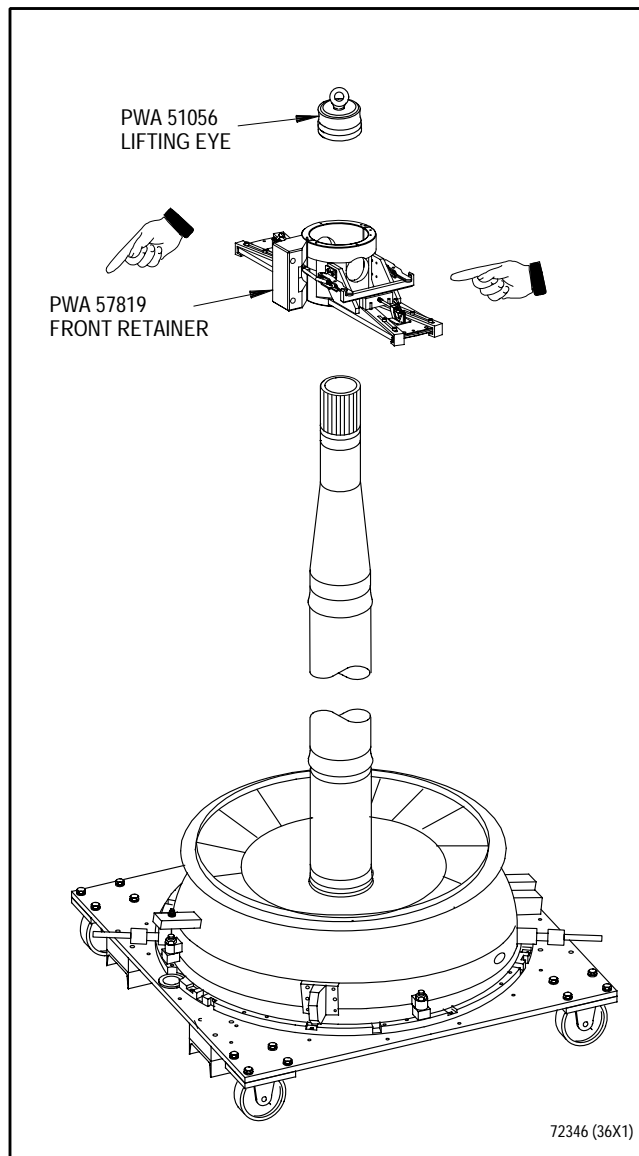


Figure 15. Front Compressor Drive Turbine Rotor and Stator - Installation into PWA 56338 Stand (Sheet 9 of 9)

**13. FRONT COMPRESSOR DRIVE TURBINE
SHAFT NUT - INSTALLATION AND TORQUE
PROCEDURE.**

(See Figure 16.)

- a. If Aerokroil penetrant was applied to nut during removal, recoat nut with PWA 36545 antigallant per WP 401 00 prior to reuse.
- b. Install and torque nut. (See figure 16.)

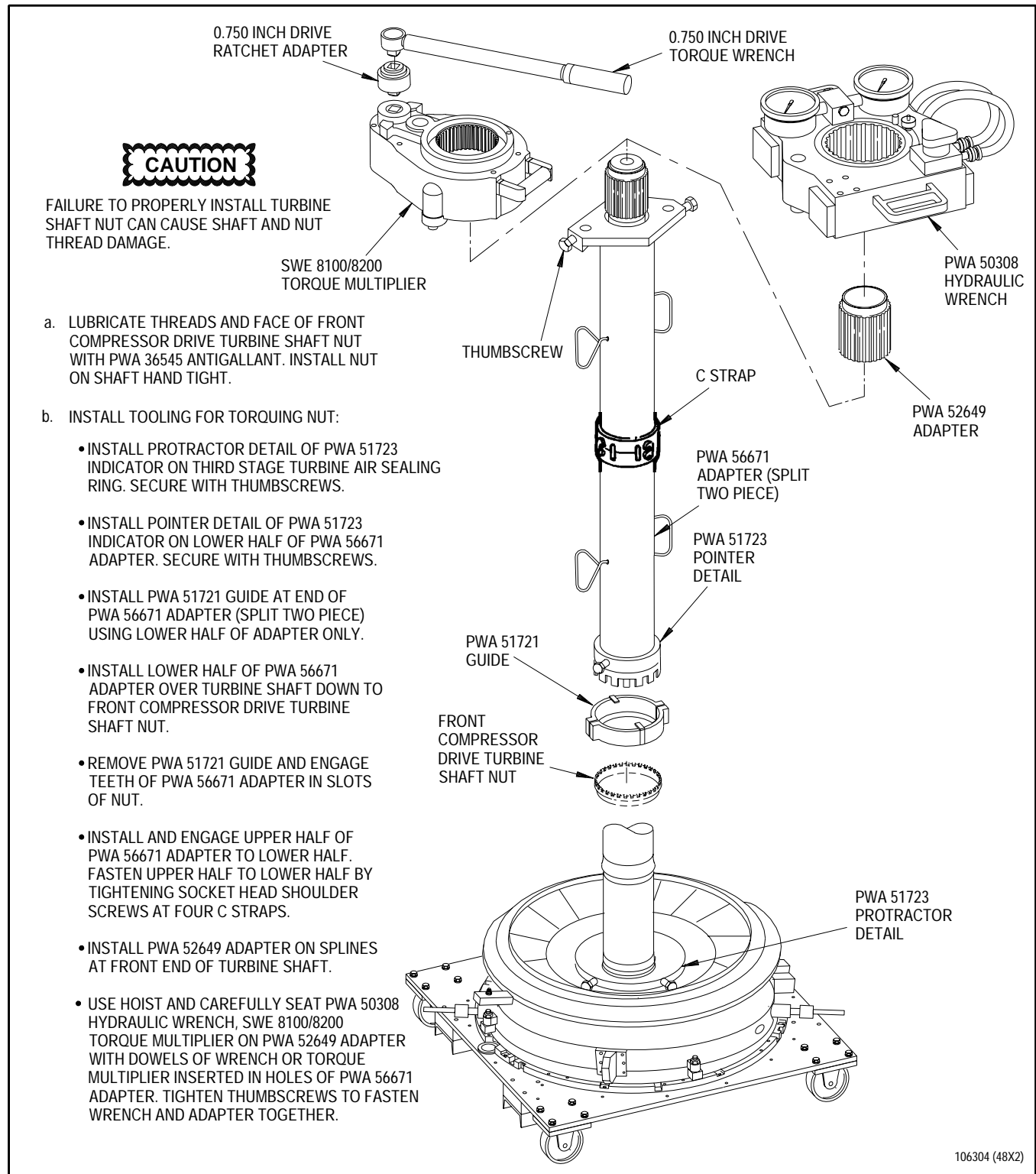


Figure 16. Front Compressor Drive Turbine Shaft Nut - Installation and Torque Procedure (Sheet 1 of 3)

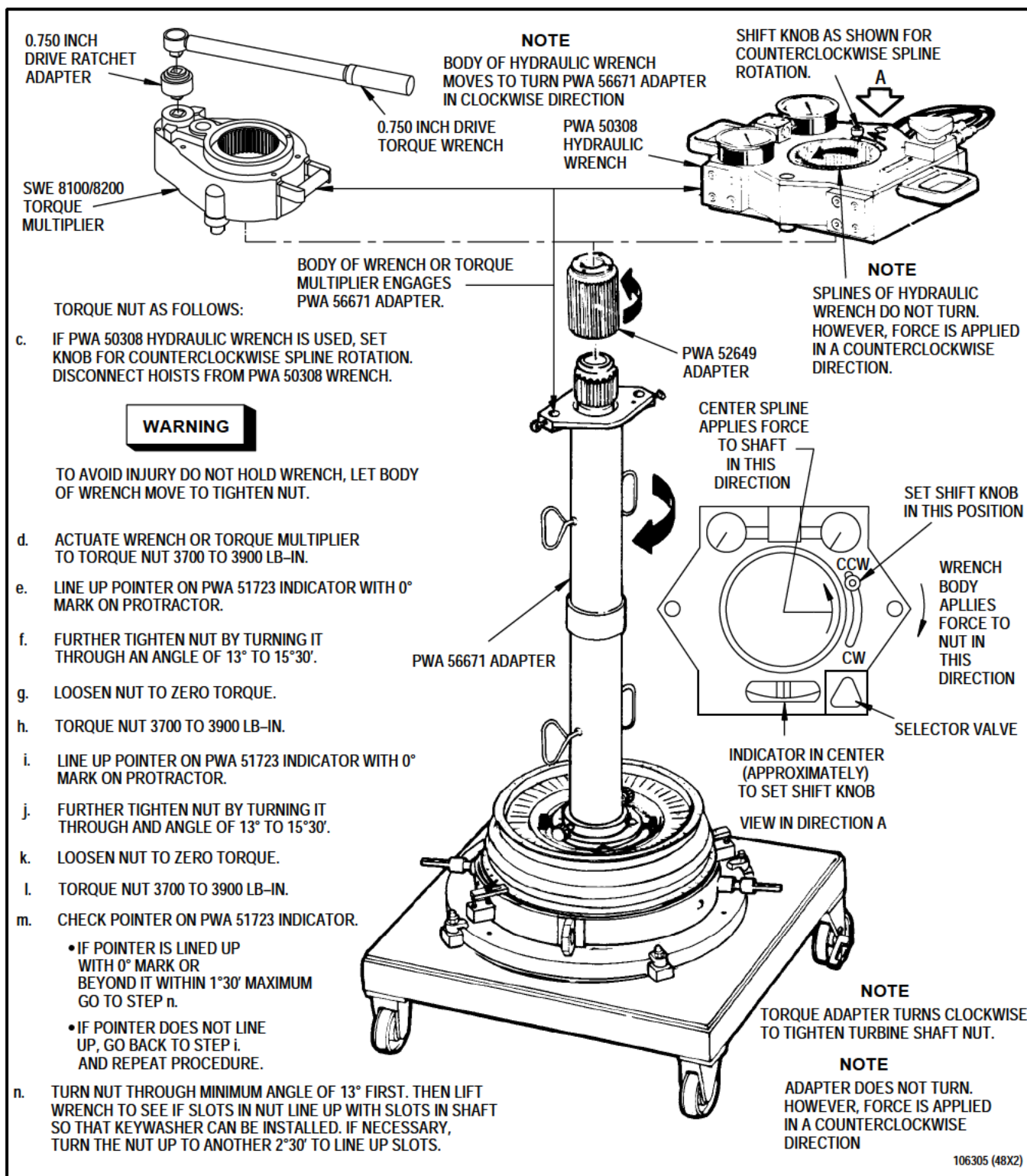


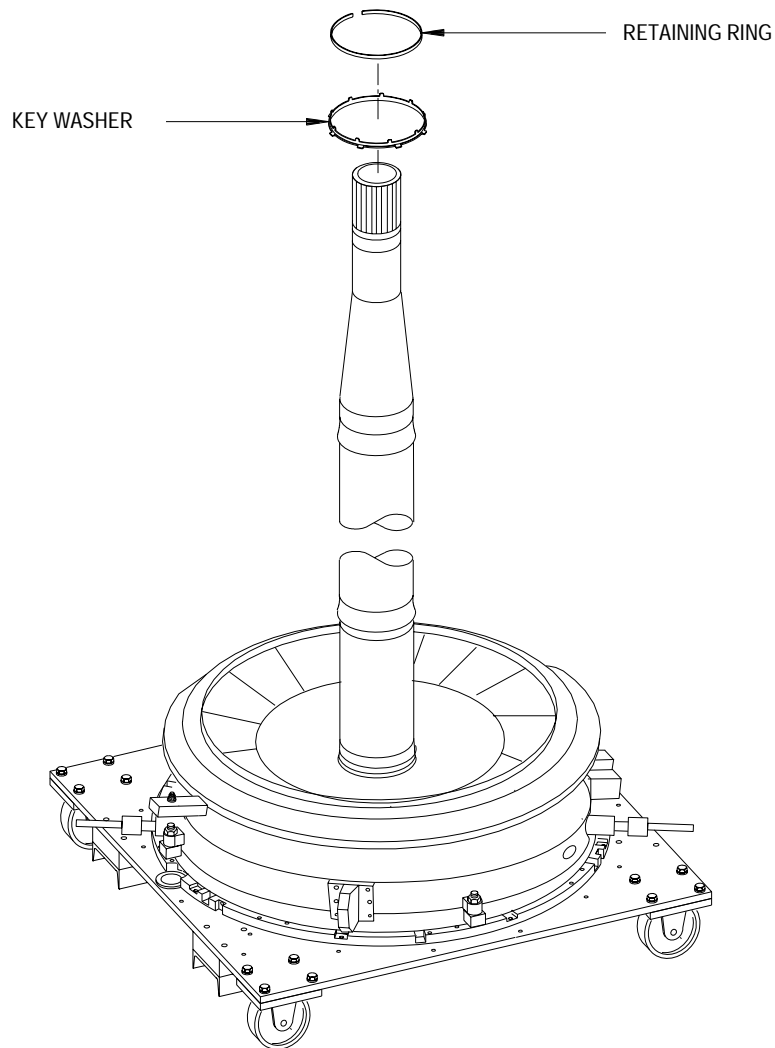
Figure 16. Front Compressor Drive Turbine Shaft Nut - Installation and Torque Procedure (Sheet 2 of 3)

o. REMOVE TOOLING:

- REMOVE PWA 50308 HYDRAULIC WRENCH OR SWE 8200/8100 TORQUE MULTIPLIER AND PWA 52649 ADAPTER.
- REMOVE UPPER HALF OF PWA 56671 ADAPTER.
- REMOVE POINTER DETAIL OF PWA 51723 INDICATOR.
- INSTALL PWA 51721 GUIDE, THEN REMOVE LOWER HALF OF PWA 56671 ADAPTER.
- REMOVE PWA 51723 PROTRACTOR DETAIL.



p. INSTALL KEY WASHER AND RETAINING RING TO SECURE NUT.



106306 (48X2)

Figure 16. Front Compressor Drive Turbine Shaft Nut - Installation and Torque Procedure (Sheet 3 of 3)

14. FOLLOW-ON MAINTENANCE.

- a. Install balance tooling per
WP 612 00.

WORK PACKAGE

TECHNICAL PROCEDURES

TOOLS, DYNAMIC BALANCING -

INSTALLATION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 8	0

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

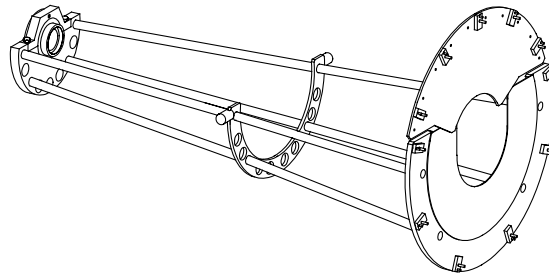
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	Installation of Balancing Tools for Dynamic Balancing	
	Fixture, Balance front compressor drive rotor and stator assembly - - - - -	PWA 57667

ILLUSTRATED SUPPORT EQUIPMENT



PWA 57667 -C

Figure T1. PWA 57667 Fixture

1. INTRODUCTION.

- a. This work package contains instructions for installation of balancing tools on front compressor drive turbine rotor and stator assembly for dynamic balancing.

2. INSTALLATION OF BALANCING TOOLS FOR DYNAMIC BALANCING.

(See Figure 1.)

- a. Install PWA 57667 front balance fixture detail-3 bearing as follows:



Failure to wear clean synthetic rubber or ling free nylon mesh gloves when handling bearings can cause damage to part.

- (1) Place detail-3 bearing and detail-21 adapter into hot oil tank at 225° to 275°F (107° to 135°C) for a minimum of ten minutes.
- (2) Visually verify that balance bearing mating surface is clean and free of foreign material.
- (3) Position heated detail-3 balance bearing and detail-21 adapter on front OD of turbine shaft. Hold detail-3 balance bearing in place until assembly temperature normalizes.

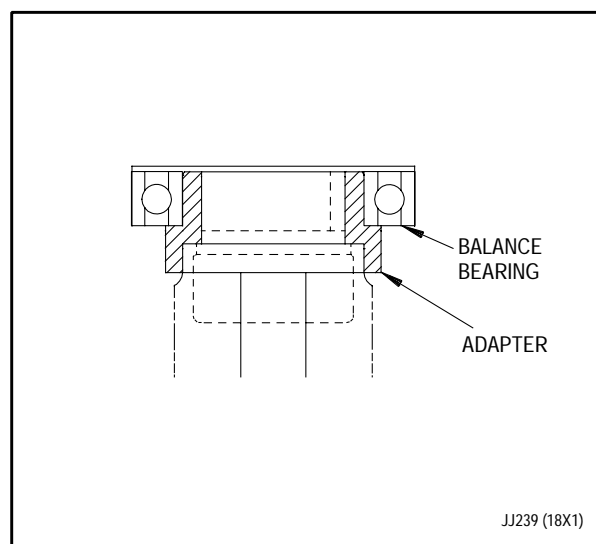


Figure 1. Front Compressor Drive Turbine Rotor and Stator - Installation of Balancing Tooling (Sheet 1 of 4)

- b. Install balancing pulley belt onto forward end of shaft.
- c. Install PWA 57667 front balance fixture as follows:
 - (1) Remove detail-17 cover and detail-4 cap from front balance fixture.
 - (2) Visually verify that balance bearing and front balance fixture mating surfaces are clean and free of foreign material.
 - (3) Using hoist and standard lifting strap, install PWA 57667 balance fixture onto rotor and stator assembly so that cradle is at 6 o'clock position and holes in flange of fixture engage pins of PWA 57659 adapters at 3 and 9 o'clock positions.

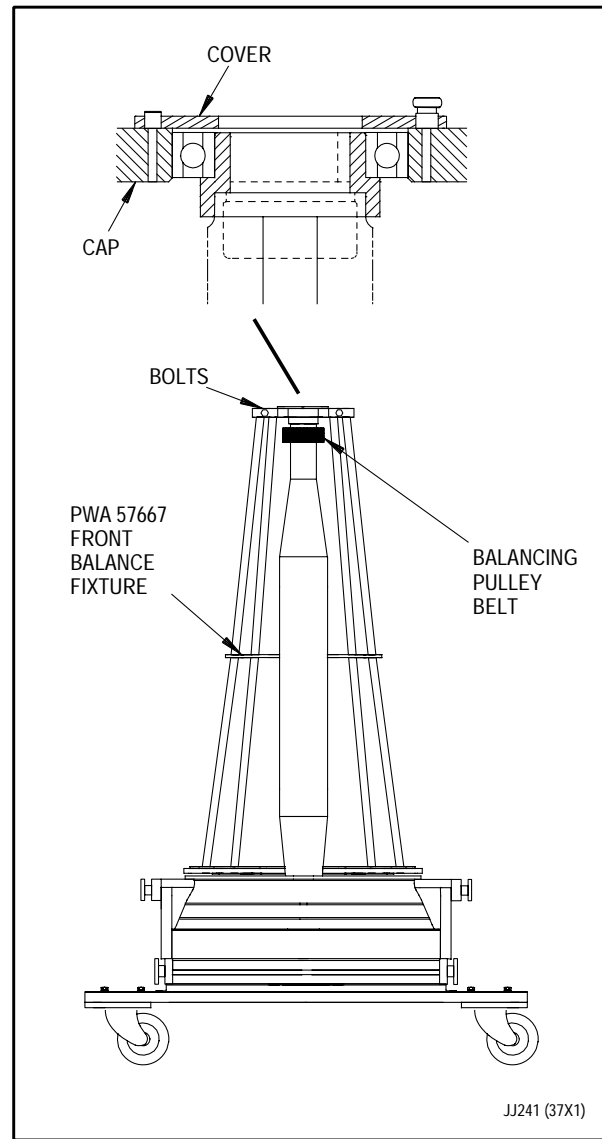


Figure 1. Front Compressor Drive Turbine Rotor and Stator - Installation of Balancing Tooling (Sheet 2 of 4)

- (4) Secure PWA 57667 balance fixture to front flange of turbine case using work nuts and bolts.
- (5) Install PWA 57667 balance fixture detail-4 cap aligning A and B markings on balance fixture with A and B markings on detail-4 cap.
- (6) Secure cap with two detail-2 bolts.
- (7) Position detail-17 cover over detail-3 bearing. Secure cover with socket-head screw and captive screw.
- (8) Install detail-15 cover assembly onto balance fixture. Secure with detail-10 clamps.
- (9) Install detail-15 cover assembly onto balance fixture. Secure cover assembly to turbine case with detail-10 clamps.
- (10) Threat detail-27 lifting eye into front end of turbine shaft.

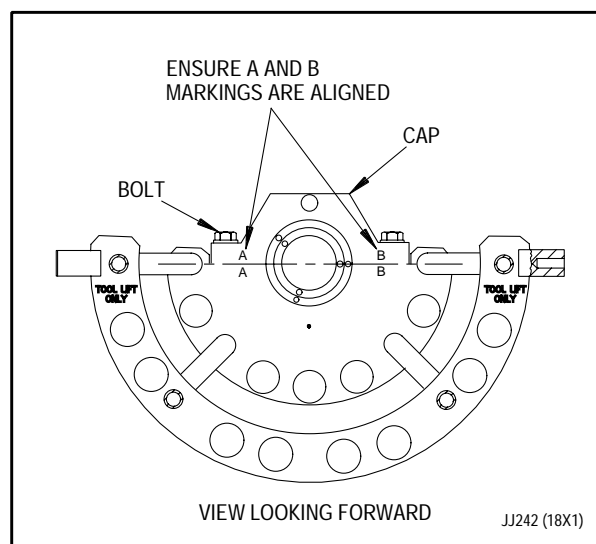


Figure 1. Front compressor Drive Turbine Rotor and Stator - Installation of Balancing Tooling (Sheet 3 of 4)

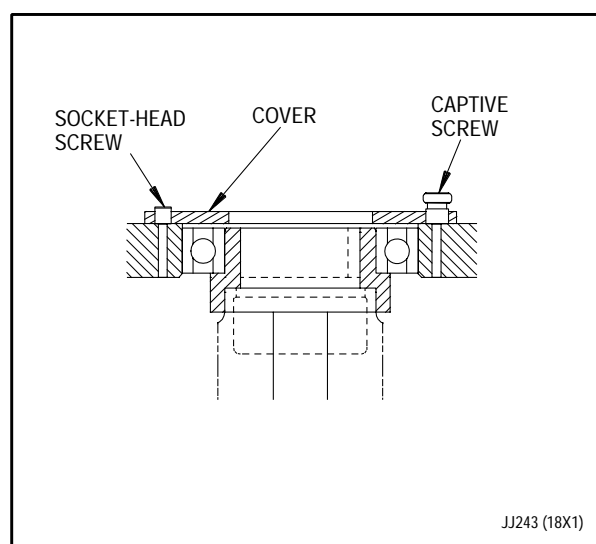


Figure 1. Front compressor Drive Turbine Rotor and Stator - Installation of Balancing Tooling (Sheet 4 of 4)

T.O. 2J-F100-53-9

WP 612 00

3. FOLLOW-ON MAINTENANCE.

- a. Balance front compressor drive turbine rotor and stator assembly per T.O. 2J-F100-53-9, WP 613 00.

WORK PACKAGE

TECHNICAL PROCEDURES

ROTOR AND STATOR ASSEMBLY, FRONT COMPRESSOR DRIVE TURBINE -

DYNAMIC BALANCING CHECK

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 12

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4	16	7	16	8 - 10	0
5 - 6	3			11 - 12	3

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
RIVET	4028248	4

APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	Front Compressor Drive Turbine Rotor and Stator Assembly - Dynamic Balance Check	
	Sling, Handling - - - - -	PWA 6580
	Trunnion Adapter (2 required) - - - - -	PWA 26147
	Riveter - - - - -	PWA 50338
	Stand - - - - -	PWA 56338
		or
		PWA 50775
	Weights, Calibration - - - - -	PWA 57654
	Adapter, Front compressor drive turbine support - - - - -	PWA 57839
		or
		PWA 57708
		or
		PWA 51719

ILLUSTRATED SUPPORT EQUIPMENT

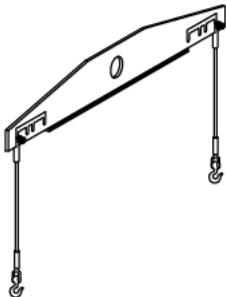


Figure T1. PWA 6580 Sling

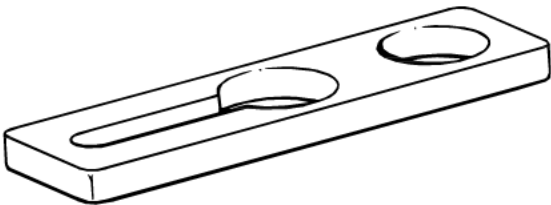
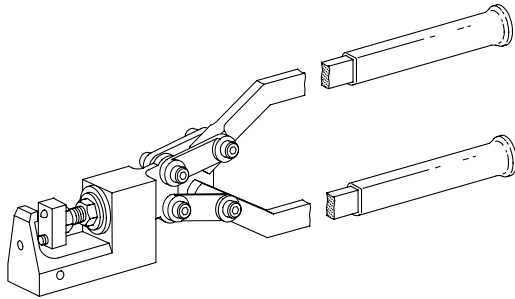


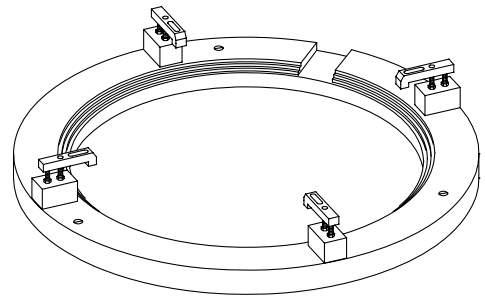
Figure T2. PWA 26147 Adapters

ILLUSTRATED SUPPORT EQUIPMENT (continued)



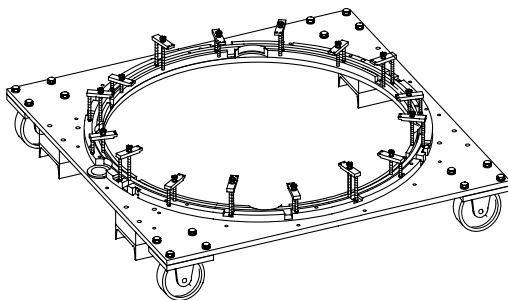
PWA 50338 -C

Figure T3. PWA 50338 Riveter



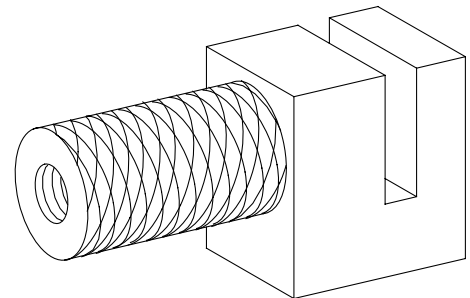
PWA 51719 -C

Figure T4. PWA 51719 Adapter



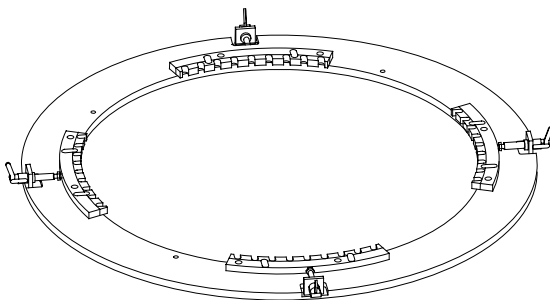
PWA 56338 -C

Figure T5. PWA 56338 Stand



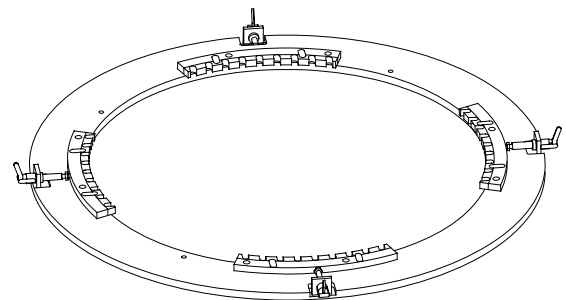
PWA 57654 -C

Figure T6. PWA 57654 Weight



PWA 57708 -C

Figure T7. PWA 57708 Adapter



PWA 57839 -C

Figure T8. PWA 57839 Adapter

1. INTRODUCTION.

- a. This work package contains instructions for dynamic balancing check of front compressor drive turbine rotor and stator assembly.

2. FRONT COMPRESSOR DRIVE TURBINE ROTOR AND STATOR ASSEMBLY - DYNAMIC BALANCE CHECK.

(See Figure 1 and Tables 1 and 2.)

- a. Install rotor and stator assembly into balance machine as follows:

- (1) Attach hoist to PWA 57667 front balance fixture detail-27 lifting eye and lift rotor and stator assembly from PWA 57839 adapter and PWA 56338 stand.
 - (2) Attach hoist, PWA 6580 sling, and PWA 26147 adapters to trunnions of PWA 57715 rear balance fixture.
 - (3) Operate hoists to rotate rotor and stator assembly to horizontal position.
 - (4) Lower rotor and stator assembly into balance machine.
 - (5) Remove hoist and PWA 57667 front balance fixture detail-27 lifting eye from front of turbine shaft.
 - (6) Remove hoist, PWA 6580 sling, and PWA 26147 adapters from trunnions of PWA 57715 rear balance fixture.
 - (7) Loosen three PWA 57715 rear balance fixture detail-9 thumbscrews and move fiber ring away from turbine shaft. Ensure fiber ring is fully retracted from turbine shaft and turbine shaft spins freely.
- b. Check squareness of front balance bearing inner race. Bearing shall be square within 0.0005 inch.
 - c. Use PWA 57654 weights to calibrate balance machine. Calibrate per balance machine instructions. Calibration weights result in a moment force of 4 ounce-inches in Plane M. (See figure 1.)

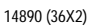


Figure 1. Front Compressor Drive Turbine Rotor and Stator Assembly - Balancing

NOTE

Use lowest belt tension to drive turbine rotor. Start up rotation speed shall be as slow as possible; then creep speed up to minimum of 500 rpm to prevent turbine blade hangup. After 500 rpm is reached, speed may be increased to minimum speed of 900 rpm using standard procedure.

- d. Locate belt drive on small shaft OD at front of shaft behind double pilot diameter. With rotor and stator assembly supported in balance machine, PWA 57667 front balance fixture and PWA 57715 rear balance fixture resting in cradles of balance machine, rotate turbine rotor clockwise as viewed from rear at minimum speed of 900 rpm.

- e. Before balancing, correct residual unbalance marked on turbine shaft(6) by one of following methods:

- (1) Subtract shaft unbalance vector from balance machine vector reading.
- (2) Add counterweights(3) at 2 places maximum in Plane M. See View A.
- (3) Apply lead tape or clay to Plane M per table 2. See View B. Place tape or clay 180 degrees (± 5 degrees) from residual unbalance mark.

NOTE

- If initial unbalance requirements cannot be met, rotor and stator assembly shall be disassembled to check for improperly seated parts or blades which were improperly moment weighed or improperly installed. See Table 1 for troubleshooting procedure.
 - Plane M, initial unbalance requirement may be met by static balancing 3rd stage disk with or without blades and 4th stage turbine air seal when fixed on Diameter P and Surface R at 900 rpm minimum. Correct by adding counterweight(3) and rivet(4) at four places maximum.
 - Initial unbalance in Plane M shall not exceed 5.00 ounce-inches. Final semi-dynamic unbalance measured in Plane M shall not exceed 0.200 ounce-inch in Plane M when rotating at minimum of 900 rpm.
- f. Semi-dynamic balance at 900 rpm minimum in Planes M and AG.

- g. If lead tape or clay was used to meet initial unbalance requirement, remove before correction.

NOTE

Maximum of six counterweights are allowed in Plane M.

- h. Correct unbalance, including marked residual unbalance(6), by adding or removing counterweight(3) and rivet(4) in Plane M.
- i. Check balance machine calibration using PWA 57654 weights as close to residual unbalance angle as possible. Calibration weights result in a moment force of 4 ounce-inches in Plane M.
- j. Record balance weight class and location in Plane M.
- k. Flare rivets(4) in Plane M using PWA 50338 riveter. Inspect counterweight rivet flare for cracks. No cracks allowed.
- l. Remove rotor and stator assembly from balance machine as follows:
 - (1) Tighten three PWA 57715 rear balance fixture detail-9 thumbscrews to secure fiber ring against turbine shaft. Ensure turbine shaft does not rotate.
 - (2) Install PWA 57667 front balance fixture detail-26 lifting eye and hoist to front end of turbine shaft.

- (3) Attach hoist, PWA 6580 sling, and PWA 26147 adapters to trunnions of PWA 57715 rear balance fixture.
- (4) Operate hoists and remove rotor and stator assembly from balance machine.
- (5) Rotate rotor and stator assembly to shaft up position.
- (6) Remove hoist, PWA 6580 sling, and PWA 26147 adapters from trunnions of PWA 57715 rear balance fixture.
- (6a) Ensure that flat side of detail-33 ring on PWA 56338 stand is facing up.
- (7) Lower rotor and stator assembly onto PWA 56338 stand or PWA 57839 Adapter and PWA 50775 Stand. Secure rotor and stator assembly using PWA 57839 adapter clamp details.
- (8) Remove hoist and PWA 57667 front balance fixture detail-26 lifting eye.

Table 1. Front Compressor Drive Turbine Rotor Troubleshooting Guide When Maximum Initial Unbalance Is Exceeded

Balance Machine Indication	Problem	Cause	Corrective Action
Unbalance angles are 180 degrees apart	Tooling balance bearing out of square	Front balance bearing inner race cocked on shaft	Square front balance bearing. Bearing shall be square within 0.0005 inch.
	Tooling belt drive out of proper position	Balance machine belt drive is binding turbine shaft.	Position belt drive on shaft OD nearest front balance bearing.
	Turbine shaft is unbalanced.	Turbine shaft was not rebalanced.	Rebalance shaft
		Balance weights on stiffener in ID of shaft are loose.	Torque balance weights and rebalance shaft.
		Shaft is bent causing runouts to exceed following acceptable limits at locations identified by corresponding limits. Refer to T.O. 2J-F100-53-9, WP 801 00, Reference TBD 0.002 inch FIR 0.005 inch FIR 0.002 inch FIR	Replace shaft.
	Disk and blade assemblies are unbalanced.	Blades were not moment weighted correctly.	Moment-weigh blades.
		Blades were not installed in disk in proper moment-weight sequence.	Install blades correctly.
	Hub is not square on shaft.	Shaft is bent causing excessive runout at hub bolting flange faces.	Replace shaft.
		Loose hub to shaft snaps	Inspect per WP 801 00. Repair per WP 402 00.
		Hub is distorted causing excessive runouts	Replace hub.

Table 1. Front Compressor Drive Turbine Rotor Troubleshooting Guide When Maximum Initial Unbalance Is Exceeded (continued)

Balance Machine Indication	Problem	Cause	Corrective Action
Unbalance angles are in line.	Turbine shaft is unbalanced.	Turbine shaft was not rebalanced.	Rebalance shaft.
		Balance weights on stiffener in ID of shaft are loose.	Torque balance weights and rebalance shaft.
		Shaft is bent causing runouts to exceed following acceptable limits at locations identified by corresponding limits. Reference to T.O. 2J-F100-13-9, WP 801 00, Reference TBD 0.002 inch FIR 0.005 inch FIR 0.002 inch FIR	Replace shaft.
	Disk and blade assemblies are unbalanced.	Blades were not moment-weighed correctly.	Moment-weigh blades.
		Blades were not installed in disk in proper moment-weight sequence.	Install blades correctly.
	Hub is not concentric to shaft bearing axis.	Loose hub to shaft snap fits.	Inspect per WP 801 00. Repair per WP 402 00.
		Loose hub to disk snap fits.	Inspect per WP 801 00. Repair per WP's 412 00, 417 00, or 422 00.

Table 1. Front Compressor Drive Turbine Rotor Troubleshooting Guide When Maximum Initial Unbalance Is Exceeded (continued)

Balance Machine Indication	Problem	Cause	Corrective Action
Meter fluctuates excessively and will not stabilize.	Excessive blade shift during balance.	Loose or tight blades caused by adverse tolerances or as-received condition.	<ol style="list-style-type: none"> 1. Lubricate blade roots with engine oil. 2. Ensure all blades are loose and not bound up by retaining plate. 3. Shroud the module openings to decrease rotor air pumping and increase recirculation of air within shroud. 4. Increase speed in 100 rpm increments until meter fluctuation is within balance limits stated in paragraph 2. 5. Control acceleration/ deceleration excursions during balancing using a vari-drive motor. 6. Prior to each acceleration position rotor in same start position. Use photo cell reflector as zero index by positioning at top dead center each time before start.

Table 1. Front Compressor Drive Turbine Rotor Troubleshooting Guide When Maximum Initial Unbalance Is Exceeded (continued)

Balance Machine Indication	Problem	Cause	Corrective Action
Meter fluctuates excessively and will not stabilize.	Tight fit between blades and seal knife-edges and honeycomb seals.	Tight fit required for increased performance.	<ol style="list-style-type: none"> 1. Rotate rotor and stator counterclockwise as viewed from rear at minimum speed of 900 rpm for a minimum of 10 minutes. 2. Rotate assembly clockwise and check meter fluctuation which should be within limits stated in paragraph 2. 3. If not within limits, remove 4th stage tip shrouds segments and repeat balance procedure in paragraph 2.

Table 2. Lead Tape or Clay Application Requirements

Marked Residual Unbalance in oz-in.	Required Lead Tape or Clay in ounces (± 0.005 oz)	Marked Residual Unbalance in oz-in.	Required Lead Tape or Clay in ounces (± 0.005 oz)	Marked Residual Unbalance in oz-in.	Required Lead Tape or Clay in ounces (± 0.005 oz)
0.05	0.010	0.80	0.110	1.55	0.210
0.10	0.010	0.85	0.120	1.60	0.220
0.15	0.020	0.90	0.120	1.65	0.220
0.20	0.030	0.95	0.130	1.70	0.230
0.25	0.030	1.00	0.140	1.75	0.240
0.30	0.040	1.05	0.140	1.80	0.240
0.35	0.050	1.10	0.150	1.85	0.250
0.40	0.050	1.15	0.160	1.90	0.260
0.45	0.060	1.20	0.160	1.95	0.260
0.50	0.070	1.25	0.170	2.00	0.270
0.55	0.070	1.30	0.180	2.05	0.280
0.60	0.080	1.35	0.180	2.10	0.280
0.65	0.090	1.40	0.190	2.15	0.290
0.70	0.090	1.45	0.200	2.20	0.300
0.75	0.100	1.50	0.200		

3. FOLLOW-ON MAINTENANCE.

- a. Remove balance tooling. Refer to T.O. 2J-F100-53-9, WP 614 00.

WORK PACKAGE

TECHNICAL PROCEDURES

TOOLS, DYNAMIC BALANCING -

REMOVAL

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 12

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 4	26	5	26	7 - 8	15
4A Added	26	6	13	9 - 10	26
4B Blank Added	26				

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T.O. No.	Date	Level	Title (ECP No.)
2J-F100229-554	15 Feb 1995	O/I	Modification of PWA 57704 adapter, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 89QA624-1)

CONSUMABLE MATERIALS

None

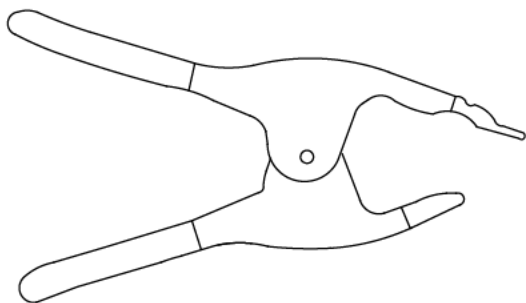
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

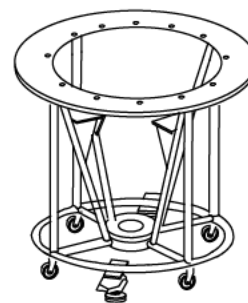
Paragraph	Function - Tool Nomenclature	Tool Number
2	REMOVAL OF BALANCING TOOLS AFTER DYNAMIC BALANCE CHECK	
	PULLER - - - - -	PWA 52773
	ADAPTER, FAN DRIVE TURBINE MODULE TO VERTICAL BUILD STAND - - - - -	PWA 57818
		OR
	ADAPTER, FDT MODULE TO VERTICAL STAND - - - - -	PWA 57704
		NSN
	STAND, VERTICAL BUILD - - - - -	4920-00-670-2592
	RETAINER, FAN DRIVE TURBINE MODULE, FRONT (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57819
		OR
	RETAINER ASSEMBLY - - - - -	PWA 57648
		OR
	RETAINER, FRONT, FAN DRIVE TURBINE MODULE - - - - -	PWA 56682
	EYE, LIFTING - - - - -	PWA 51056
	SLING, HANDLING - - - - -	PWA 6580
	TRUNNION ADAPTER - - - - -	PWA 26147
	CLAMP - - - - -	LM 1021
	BEARING, BALANCE ASSY, FAN DRIVE TURBINE, REAR - - -	PWA 51046
	SPACER, FAN DRIVE TURBINE, REAR BALANCE BEARING - - -	PWA 56729
		OR
	SPACER, FAN DRIVE TURBINE REAR BALANCE BEARING - - -	PWA 51045
	HOLDER - - - - -	PWA 51051
	WRENCH - - - - -	PWA 51048
	PULLER - - - - -	PWA 53879
		OR
	PULLER - - - - -	PWA 51061
	PUMP, HYDRAULIC HAND - - - - -	PWA 55380

ILLUSTRATED SUPPORT EQUIPMENT



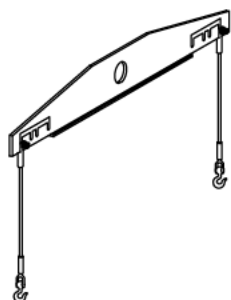
LM 1021 -C

Figure T1. LM 1021 CLAMP



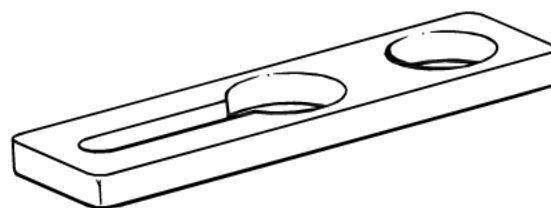
NSN4920-00-670-2592 -C

Figure T2. NSN 4920-00-670-2592 STAND



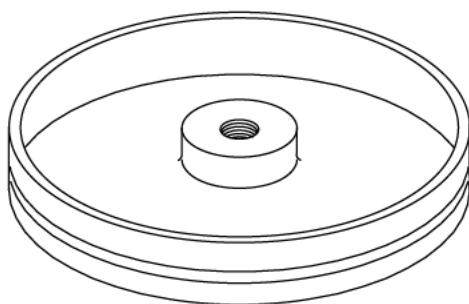
PWA 6580 -C

Figure T3. PWA 6580 SLING



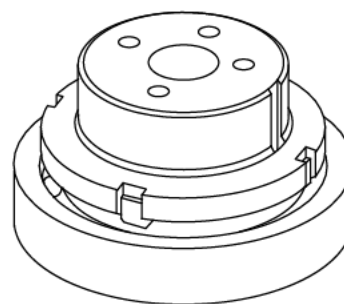
PWA 26147 -C

Figure T4. PWA 26147 TRUNNION ADAPTER



PWA 51045 -C

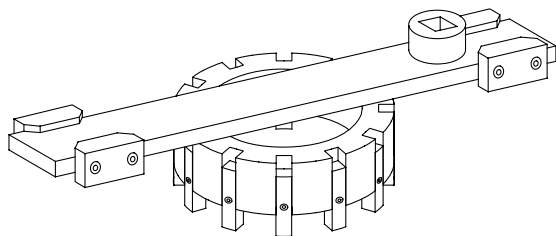
Figure T5. PWA 51045 SPACER



PWA 51046 -C

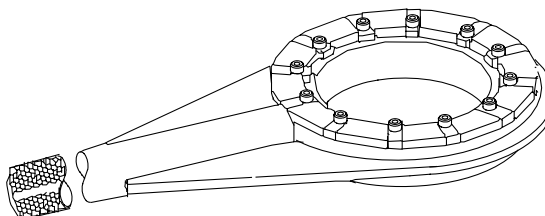
Figure T6. PWA 51046 BEARING

ILLUSTRATED SUPPORT EQUIPMENT (continued)



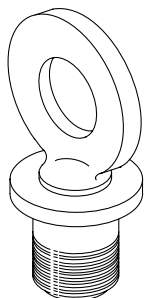
PWA 51048 -C

Figure T7. PWA 51048 WRENCH



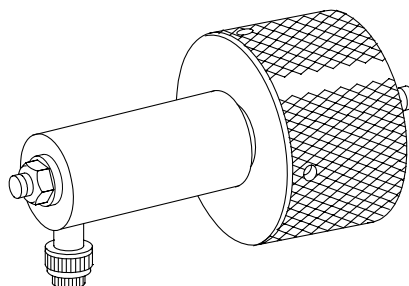
PWA 51051 -C

Figure T8. PWA 51051 HOLDER



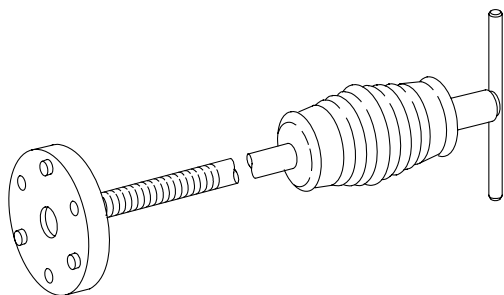
PWA 51056 -C

Figure T9. PWA 51056 EYE



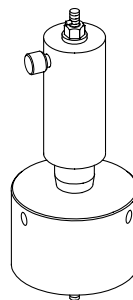
PWA 51061 -C

Figure T10. PWA 51061 PULLER



PWA 52773 -C

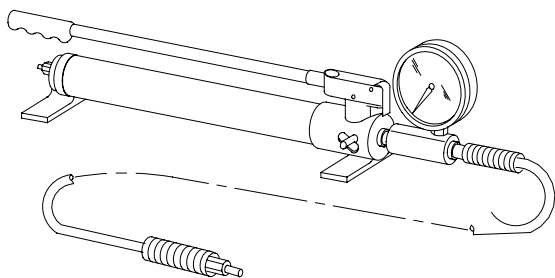
Figure T11. PWA 52773 PULLER



PWA 53879 -C

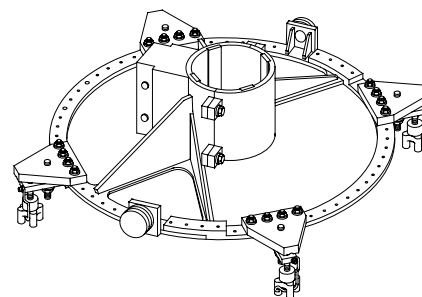
Figure T12. PWA 53879 PULLER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



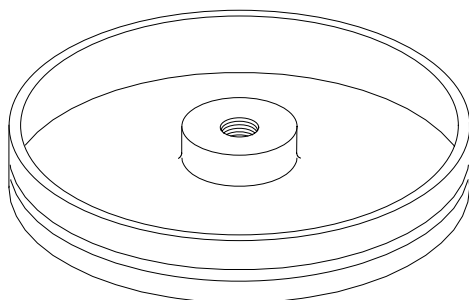
PWA 55380 -C

Figure T13. PWA 55380 PUMP



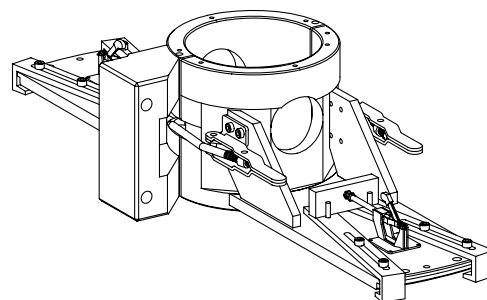
PWA 56682 -C

Figure T14. PWA 56682 RETAINER



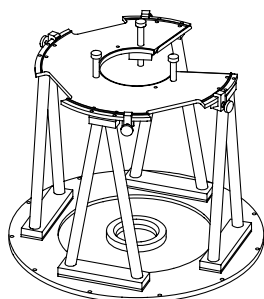
PWA 56729 -C

Figure T15. PWA 56729 SPACER



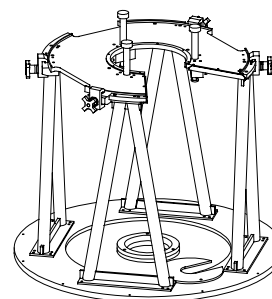
PWA 57648 -C

Figure T16. PWA 57648 RETAINER ASSEMBLY



PWA 57704 -C

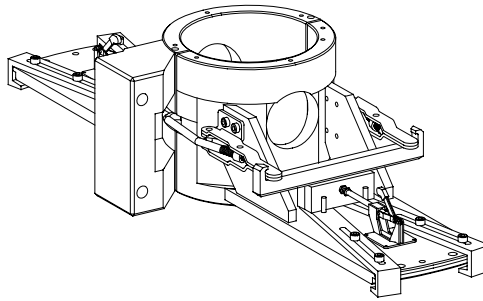
Figure T17. PWA 57704 ADAPTER



PWA 57818 -C

Figure T18. PWA 57818 ADAPTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



PWA 57819 -C

Figure T19. PWA 57819 RETAINER

1. INTRODUCTION.

- a. This work package contains instructions for removal of balancing tools after dynamic balance check.

2. REMOVAL OF BALANCING TOOLS AFTER DYNAMIC BALANCE CHECK.

(See Figure 1.)

- a. Remove PWA 57667 front balance fixture as follows:
 - (1) Loosen socket-head screw and rotate PWA 57667 front balance fixture detail-17 cover outward. (See figure 1, Sheet 1.)
 - (2) Remove bolts securing detail-4 cap. Remove detail-4 cap. (See figure 1, Sheet 2.)
 - (3) Loosen detail-10 clamps and remove detail-15 cover.
 - (4) Attach hoist and standard lifting strap to PWA 57667 front balance fixture.
 - (5) Remove bolts and nuts securing balance fixture rear flange to turbine case.
 - (6) Operate hoist and remove front balance fixture.
 - (7) Remove detail-3 balance bearing using PWA 52773 puller and three allen head screws of appropriate size.
 - (8) Store bearing in protective container.

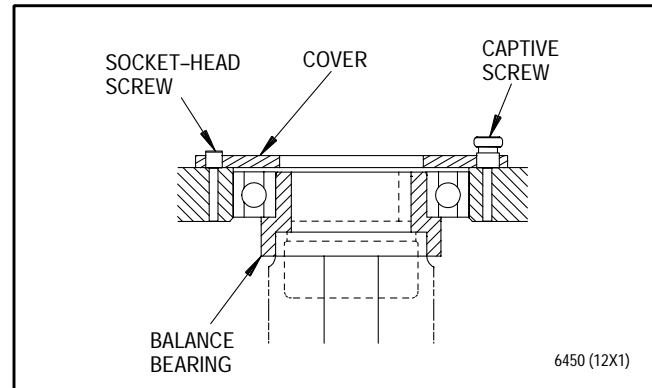


Figure 1. Front Compressor Drive Turbine Rotor and Stator Assembly - Balancing Tooling Removal (Sheet 1 of 6)

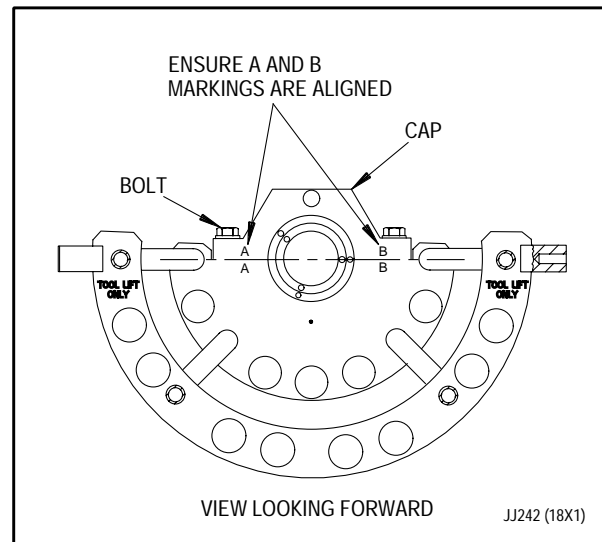


Figure 1. Front Compressor Drive Turbine Rotor and Stator Assembly - Balancing Tooling Removal (Sheet 2 of 6)

b. Install front compressor drive turbine rotor and stator assembly into vertical build stand as follows:

- (1) Install PWA 57818 adapter on NSN 4920-00-670-2592 stand. Secure with washers and hex-head cap screws.
- (2) Install PWA 57819 front retainer.
- (3) Install PWA 51056 lifting eye in front end of turbine shaft.
- (4) Attach hoist to PWA 51056 lifting eye.
- (5) Loosen PWA 51719 adapter clamp details securing turbine case rear flange. Ensure clamps are positioned so that turbine case will clear clamps during removal.
- (6) Attach hoist, PWA 6580 sling, and PWA 26147 adapters to trunnions of PWA 57715 rear balance fixture.
- (7) Operate hoists to rotate rotor and stator assembly to shaft down position.
- (8) Remove hoist and PWA 51056 lifting eye from front end of turbine shaft.

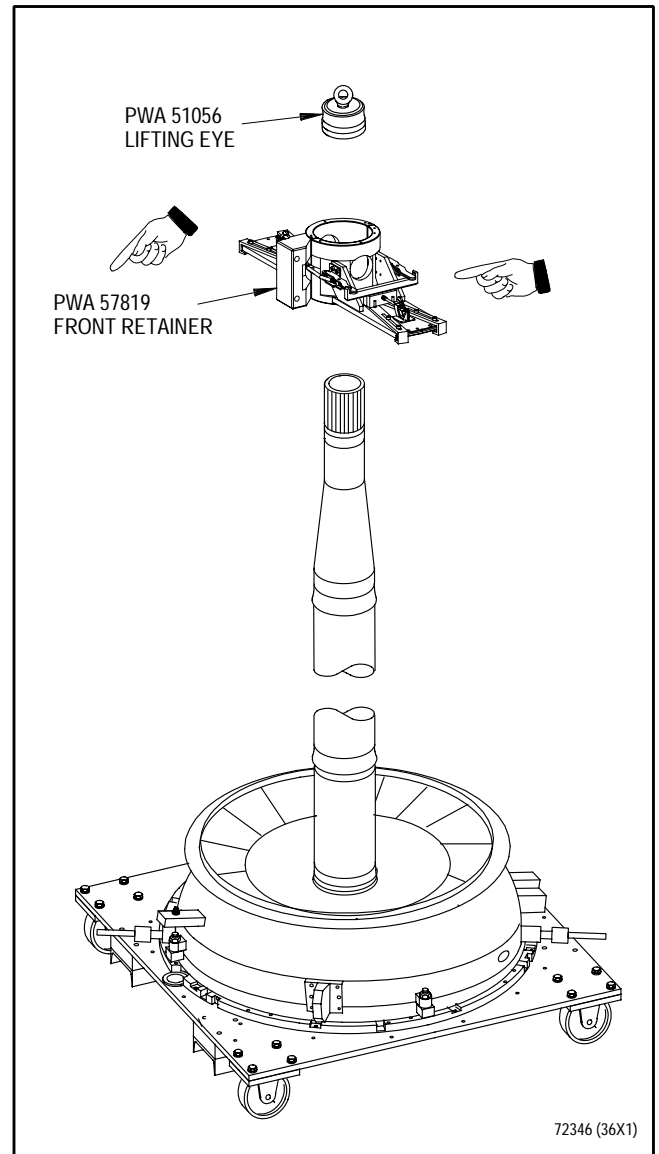


Figure 1. Front Compressor Drive Turbine Rotor and Stator Assembly - Balancing Tooling Removal (Sheet 3 of 6)

CAUTION

Second stage turbine duct and support set is loose fit inside rear turbine case and will be damaged if allowed to fall from case during handling.

- (9) Install two LM 1021 clamps 180 degrees apart on turbine case front flange to hold second stage turbine duct support in place.
 - (10) Remove PWA 57819 front retainer.
 - (11) Lower rotor and stator assembly into PWA 57818 adapter. Remove two LM 1021 clamps before front flange of turbine case is fully seated on adapter.
 - (12) Remove hoist, PWA 6580 sling, and PWA 26147 adapters from PWA 57715 rear balance fixture.
- c. Remove PWA 57715 rear balance fixture as follows:
- (1) Loosen three thumb screws to release fiber ring from turbine shaft.
 - (2) Remove four cap screws securing ID of balance fixture to balance bearing.
 - (3) Remove bolts securing balance fixture to rear turbine flange.
 - (4) Attach PWA 6580 sling and hoist to PWA 57715 rear balance fixture trunnions.
 - (5) Carefully lift and remove balance fixture.

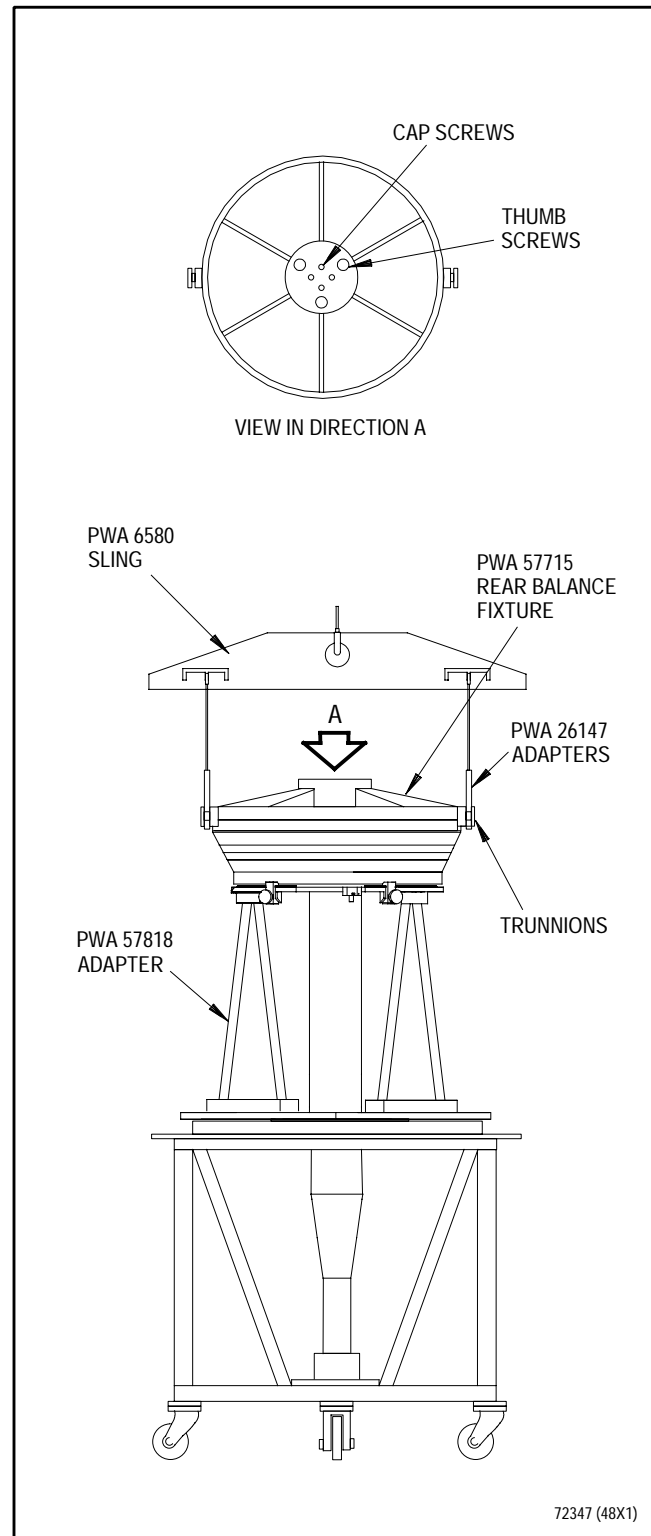


Figure 1. Front Compressor Drive Turbine Rotor and Stator Assembly - Balancing Tooling Removal (Sheet 4 of 6)

- d. Remove PWA 51046 balancing bearing and PWA 56729 spacer as follows:



Outer race retaining nut has left hand thread. Failure to remove nut properly can result in damage to turbine shaft and nut.

- (1) Remove balance bearing retaining nut using PWA 51051 holder and PWA 51048 wrench. Turn nut clockwise to remove.

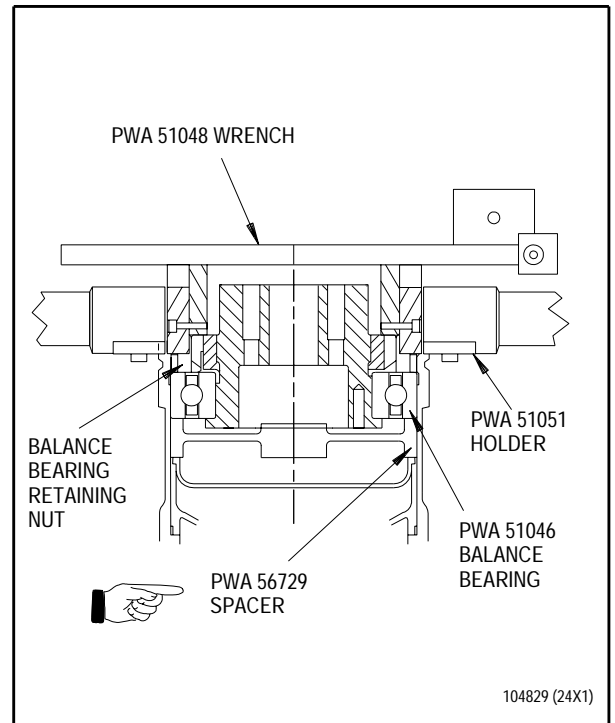


Figure 1. Front Compressor Drive Turbine Rotor and Stator Assembly - Balancing Tooling Removal (Sheet 5 of 6)

- (2) Thread PWA 53879 puller detail-1 body onto rear of turbine shaft, and thread detail-3 rod into PWA 56729 spacer. (See figure 1, Sheet 6.)
- (3) Thread detail-4 nut down on rod to detail-2 hydraulic cylinder.
- (4) Connect PWA 55380 hand pump to cylinder and actuate pump to pull assembly from ID of shaft.
- (5) Remove puller, bearing, and spacer.
- (6) Install protective cover on turbine.

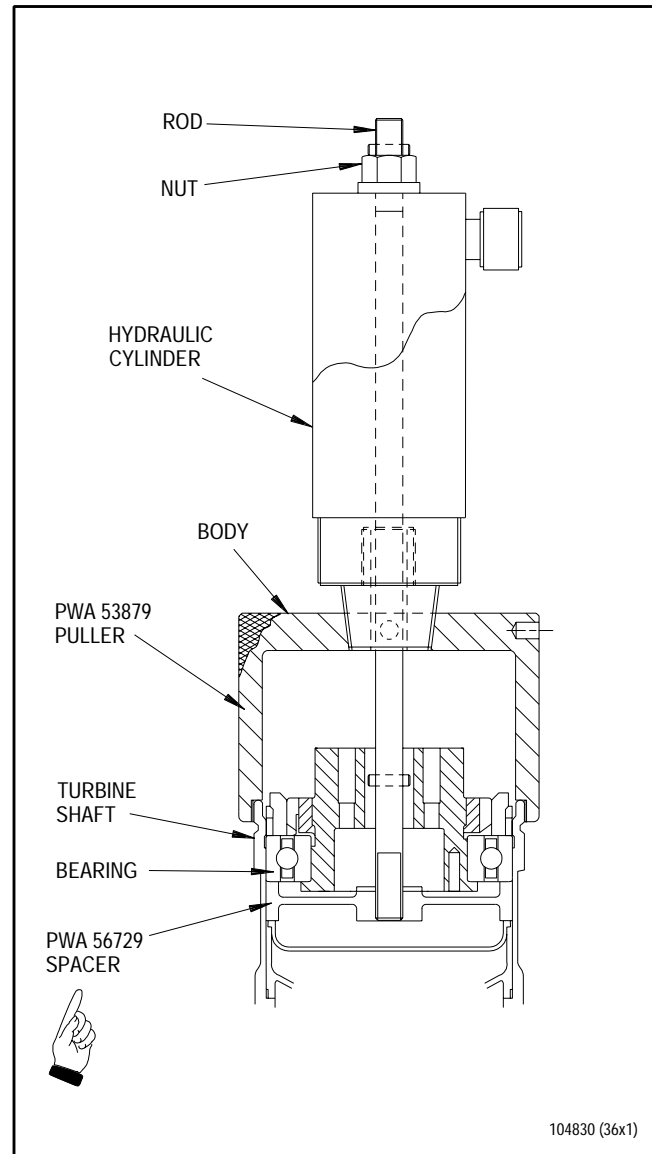


Figure 1. Front Compressor Drive Turbine Rotor and Stator Assembly - Balancing Tooling Removal (Sheet 6 of 6)

3. FOLLOW-ON MAINTENANCE.

- a. Complete final assembly of front compressor drive turbine rotor and stator assembly per WP 701 00.

WORK PACKAGE

TECHNICAL PROCEDURES

BLADE, TURBINE ROTOR, THIRD STAGE -

MOMENT-WEIGHT CLASSIFICATION

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 5	18	6 Blank	18		

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
CRAYON, METAL MARKING (HARD)	COLORBRITE SILVER NO. 2101 OR ANADEL NO. 1936 OR COLOR-TEX SILVER NO. 1843

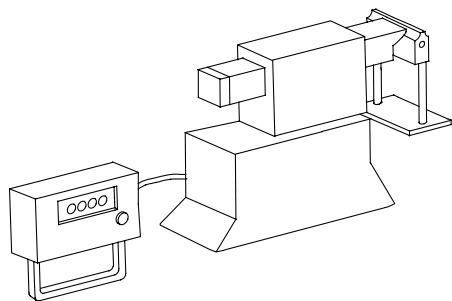
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

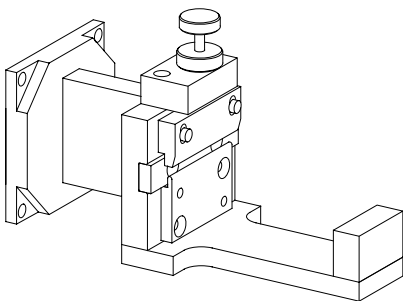
Paragraph	Function - Tool Nomenclature	Tool Number
2	THIRD STAGE TURBINE ROTOR BLADE - MOMENT-WEIGHT CLASSIFICATION THIRD STAGE TURBINE ROTOR BLADE, MOMENT, WEIGHT CLASSIFICATION - - - - - ADAPTER, 3RD STAGE TURBINE BLADE MOMENT, WEIGHT - - TESTER, MOMENT, WEIGHT BLADES - - - - -	 PWA 57757 PWA 55456

ILLUSTRATED SUPPORT EQUIPMENT



PWA 55456 -C

Figure T1. PWA 55456 TESTER



PWA 57757 -C

Figure T2. PWA 57757 ADAPTER

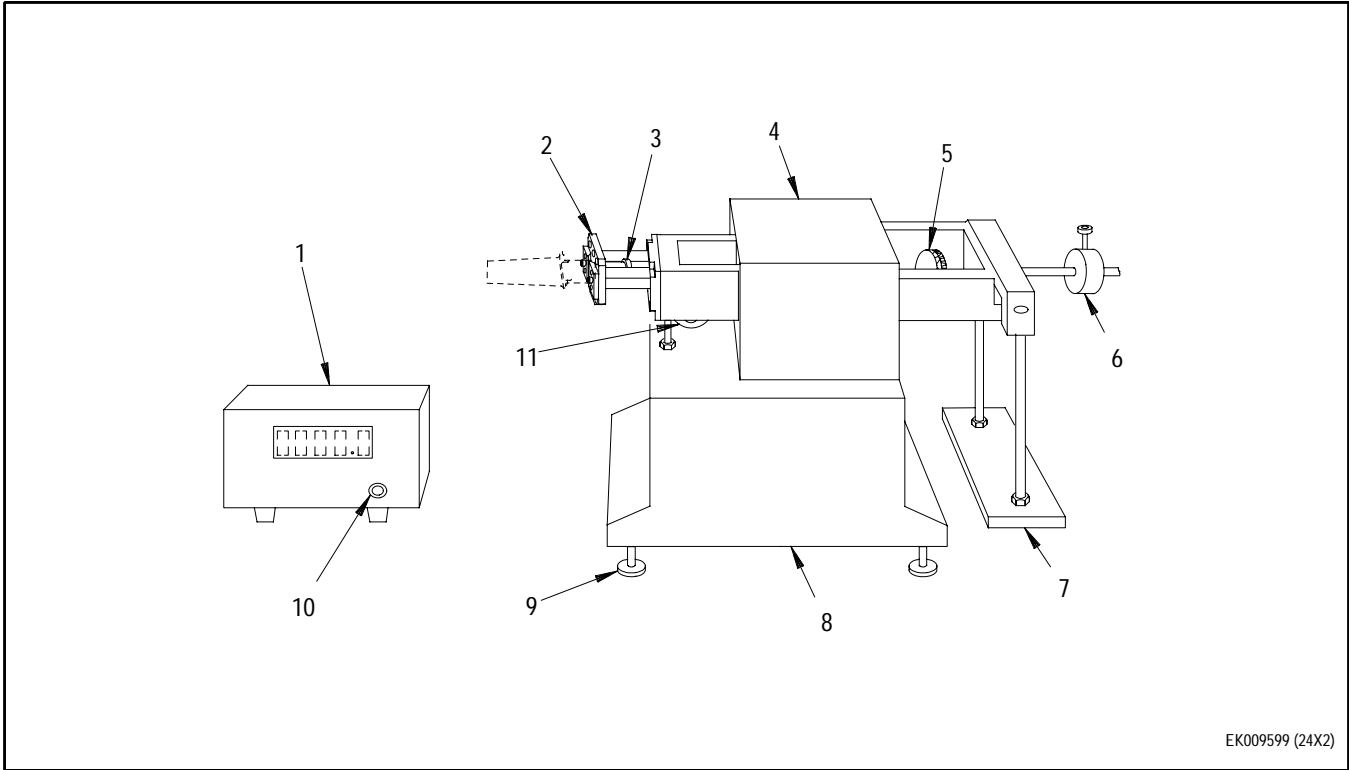
1. INTRODUCTION.

- a. This work package contains instructions for moment-weight classification of 3rd stage turbine blade.

2. THIRD STAGE TURBINE ROTOR BLADE - MOMENT-WEIGHT CLASSIFICATION.

(See Figure 1 and Table 1.)

- a. Check table 1 for proper adapter and its matching counterweight.
- b. Verify adapter and tester are calibrated. Refer to procedure outlined in manufacturer's manual.
- c. Check bull's eye level(11, figure 1). Adjust leveling feet(9) as required to level tester.
- d. Install adapter(2).
- e. Install master blade concave side up into adapter by backing out locking screw(3), inserting blade, and tightening locking screw fingertight.
- f. Mark location of locking screw knurled knob. Back out locking screw 1/4 to 1/2 turn and remove master blade. Turn locking screw back into marked location.
- g. Turn digital readout(1) on and warmup 15 minutes minimum to ensure accurate calibration.
- h. Center zero adjust control(10) on digital readout panel by turning control knob counterclockwise to stop, then clockwise, counting total number of turns of knob to stop, then counterclockwise one-half number of full and fractional turns.
- i. Remove any counterweights from counterweight pan(7).
- j. Select coarse balance counterweight(6) and install on proper coarse balance rod. Adjust coarse balance counterweight until initial balance of 10.00 ounce-inches or less is obtained.
- k. Adjust knurled weights(5) inside main lever at rear of tester to obtain medium balance of 2.00 ounce-inches or less.



- | | |
|--------------------|-------------------------|
| 1. Digital readout | 7. Counterweight pan |
| 2. Adapter | 8. Tester base |
| 3. Locking screw | 9. Leveling foot |
| 4. Dust cover | 10. Zero adjust control |
| 5. Knurled weights | 11. Bull's eye level |
| 6. Counterweight | |

Figure 1. PWA 55456 Moment-Weight Tester

Table 1. Third Stage Turbine Rotor Blade - Moment-Weight Tools

Tester	Blade Stage	Adapter	Master Blade
PWA 55456 (0 to 10) range, 8.900 inch fulcrum	3rd stage turbine	PWA 57757	Any blade of appropriate part number and known moment-weight.

- l. Adjust zero adjust control(10) on digital readout panel to read 0.00 \pm 0.01 ounce-inch.
- m. Install master blade concave side up. If blade is heavier than 100.00 ounce-inches, place counterweight as required on counterweight hanger pan to bring scale within range.

NOTE

Moment-weight values are in large white numerals located on concave side of airfoil near tip.

- n. Reading on digital readout(11) should equal weight marked on master blade within \pm 0.02 ounce-inch. If not, recalibrate tester.

NOTE

Periodic checks shall be made with master blade to ensure tester accuracy.

- o. Install blade to be moment-weighed in adapter(2) concave side up.
- p. Allow approximately 3 seconds for digital readout(1) to stabilize.
- q. Record moment-weight reading from digital readout(1).
- r. Remove blade from adapter(2) and mark moment-weight in large numerals on concave side of airfoil near tip using Colorbrite No. 2101 metal marking crayon or equivalent.

WORK PACKAGE

TECHNICAL PROCEDURES

BLADE, TURBINE ROTOR, FOURTH STAGE -

MOMENT-WEIGHT CLASSIFICATION

EFFECTIVITY: ENGINE MODEL F100-PW-229

This Work Package Supersedes WP 616 00 Through and Including Change 0.

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 6

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 6					
					21

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
CRAYON, METAL MARKING (HARD)	COLORBRITE SILVER NO. 2101 OR ANADEL NO. 1936 OR COLOR-TEX SILVER NO. 1843

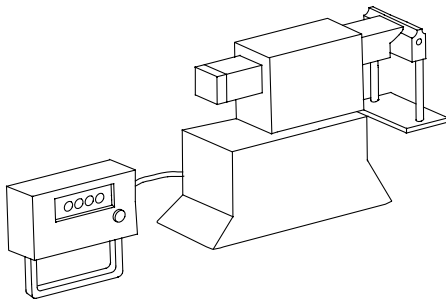
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

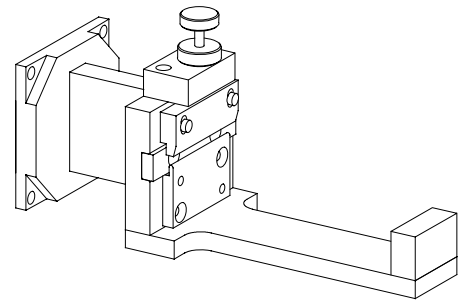
Paragraph	Function - Tool Nomenclature	Tool Number
2	FOURTH STAGE TURBINE ROTOR BLADE - MOMENT-WEIGHT CLASSIFICATION	
	FOURTH STAGE TURBINE ROTOR BLADE, MOMENT, WEIGHT CLASSIFICATION - - - - -	
	ADAPTER, MOMENT WEIGHT, FAN DRIVE TURBINE BLADE, 4TH STAGE - - - - -	PWA 57851 OR
	ADAPTER, 4TH STAGE TURBINE BLADE MOMENT, WEIGHT - -	PWA 57758
	TESTER, MOMENT, WEIGHT BLADES - - - - -	PWA 55456

ILLUSTRATED SUPPORT EQUIPMENT



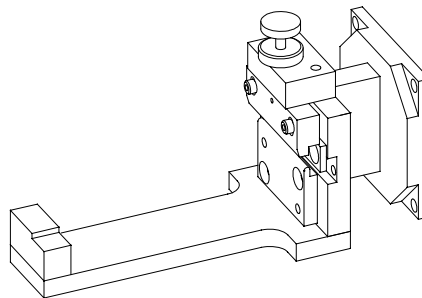
PWA 55456 -C

Figure T1. PWA 55456 TESTER



PWA 57758 -C

Figure T2. PWA 57758 ADAPTER



PWA 57851 -C

Figure T3. PWA 57851 ADAPTER

1. INTRODUCTION.

- a. This work package contains instructions for moment-weight classification of 4th stage turbine blade.

2. FOURTH STAGE TURBINE ROTOR BLADE - MOMENT-WEIGHT CLASSIFICATION.

(See Table 1 and Figure 1.)

- a. Check table 1 for proper adapter and its matching counterweight.

NOTE

Periodic calibration checks shall be made with master blade to ensure tester accuracy.

- b. Verify PWA 55456 tester has been calibrated. Refer to procedure outlined in manufacturer's manual.
- c. Check bull's eye level(11, figure 1). Adjust leveling feet(9) as required to level tester.
- d. Install adapter(5).
- e. Turn digital readout(1) on and warmup 15 minutes minimum to ensure accurate calibration.

- f. Center zero adjust control(13) on digital readout panel by turning control knob counterclockwise to stop, then clockwise, counting total number of turns of knob to stop, then counterclockwise one-half number of full and fractional turns.

- g. Remove any counterweights from counterweight pan(9).

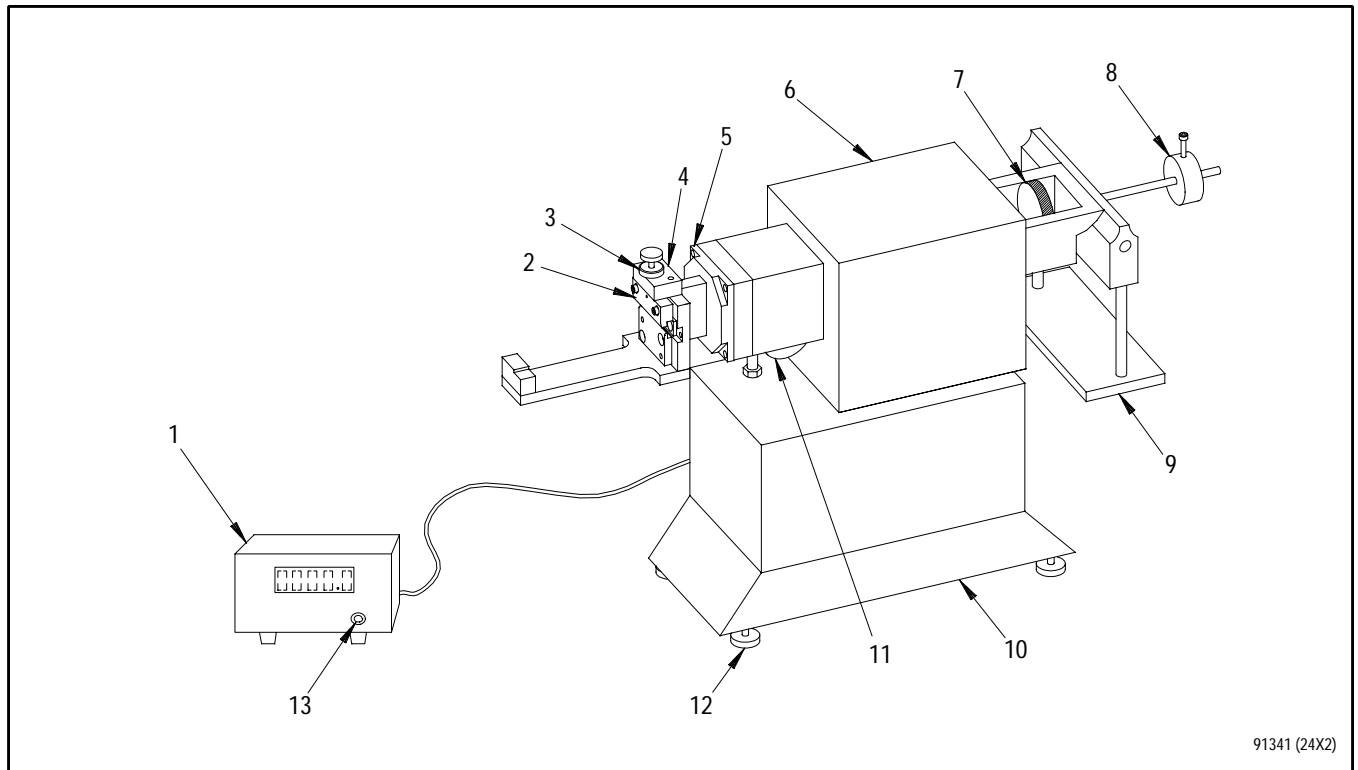
- h. Select coarse balance counterweight(8) and install on proper coarse balance rod. Adjust coarse balance counterweight until initial balance of 10.00 ounce-inches or less is obtained.

- i. Adjust knurled weights(7) inside main lever at rear of tester to obtain medium balance of 2.00 ounce-inches or less.

- j. Adjust zero adjust control(13) on digital readout panel to read 0.00 \pm 0.01 ounce-inch.

Table 1. Fourth Stage Turbine Rotor Blade - Moment-Weight Tools

Tester	Blade Stage	Adapter	Master Blade
PWA 55456 (0 to 10) range, 7.656 to 7.658 inch fulcrum	4th stage turbine (PN 4082504)	PWA 57851	Any blade of appropriate part number and known moment-weight.
PWA 55456 (0 to 10) range, 7.656 to 7.658 inch fulcrum	4th stage turbine (All other PNs)	PWA 57758	Any blade of appropriate part number and known moment-weight.



- | | |
|------------------------|-------------------------|
| 1. Digital readout | 8. Counterweight |
| 2. Spring loaded clamp | 9. Counterweight pan |
| 3. Locking nut | 10. Tester base |
| 4. Retainer | 11. Bull's eye level |
| 5. Adapter | 12. Leveling foot |
| 6. Dust cover | 13. Zero adjust control |
| 7. Knurled weights | |

Figure 1. PWA 55456 Moment-Weight Tester

- k. Install preestablished moment-weighed blade into adapter as follows:
 - (1) Turn locking nut(3) clockwise to lift spring loaded jaw(2).
 - (2) Insert blade concave side up into adapter and position so that trailing edge of blade root contacts locator pin.
 - (3) Turn locking nut counterclockwise to secure blade with spring loaded jaw.
 - (4) Secure locking nut by turning clockwise until nut contacts top surface of retainer(4).

NOTE

Moment-weight values are in large white numerals located on concave side of airfoil near tip.

- l. Place 10.00 ounce counterweight on counterweight hanger pan(9) if blade is heavier than 100.00 ounce-inches. Compare moment-weight reading to preestablished blade moment-weight.
- m. Remove blade and ensure tester reverts back to ZERO.
- n. Reinstall same blade and moment-weigh again. Verify moment-weight is consistent with previous moment-weight within +/-0.002 ounce-inches or less.

NOTE

Paired moment-weighed blades consist of two blades having a moment-weight within 0.200 ounce-inch of each other.

- o. Install preestablished paired moment-weighed blade, concave side up and repeat steps l through n.
- p. Reading on digital readout(1) should equal weight marked on paired blade within ± 0.02 ounce-inch. If not, recalibrate tester.

NOTE

Periodic checks shall be made with master blade to ensure tester accuracy.

- q. Install blade to be moment-weighed in adapter one at a time.
- r. Allow approximately 3 seconds for digital readout to stabilize.
- s. Record moment-weight reading from digital readout.
- t. Remove blade from adapter(5) and mark moment-weight in large numerals on concave side of airfoil. Mark in area reserved using nonetching ink, layout dye, or Colorbrite No. 2101 metal marking crayon.

WORK PACKAGE

INTRODUCTION

FAN DRIVE TURBINE MODULE -

FINAL ASSEMBLY

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 2

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	0

T.O. 2J-F100-53-9

WP 700 00

1. INTRODUCTION.

This work package introduces the 700 through 799 series of work packages for final assembly of the fan drive turbine module. The following work packages are included:

WP/SWP No.	Title
701 00	Fan Drive Turbine Module - Final Assembly
702 00	Compartment, No. 5 Bearing - Airflow and Vacuum Checks
703 00	Fan Drive Turbine Module - Transfer From Build Stand to PWA 10673 Truck
704 00 through 799 00	Open

WORK PACKAGE**TECHNICAL PROCEDURES****FAN DRIVE TURBINE MODULE -****FINAL ASSEMBLY****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 32

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	29	6B Blank	20	11 - 12D	29
2 - 3	27	7 - 8A	11	13	21
4	0	8B	27	14	0
4A	24	9	27	15	24
4B Blank	20	10	29	16	28
5	27	10A Added	29	16A Added	24
6	20	10B Blank Added	29	16B Blank Added	24
6A	23			17 - 18	15

REFERENCE MATERIAL REQUIRED

Title	Number
Standard Maintenance Procedures - - - - -	T.O. 2-1-111
Depot Engine - - - - -	T.O. 2J-F100-53-5
Borescope/Fibrescope Inspection - Equipment and Operation - - - - -	WP 021 00
Propeller and Engine Shaft Wrenches - - - - -	T.O. 32A5-2-2-1
Wrench, Hydraulic, PWA 50308 - - - - -	T.O. 32B14-5-2-1

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
Compound, antigalling (PWA 36035)	Fel-Pro C-300
Compound, antiseize (PWA 36053-3)	Loctite Nickel Anti-Seize 771
Lubricant, sealing ring (PWA 36500)	Ultrachem Assembly Fluid No. 1
Oil, lubricating	MIL-L-7808

EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
Seal, plain	4075857	2
Seal, plain	4075858	1

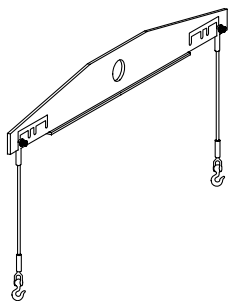
APPLICABLE SUPPORT EQUIPMENT

Paragraph	Function - Tool Nomenclature	Tool Number
2	TURBINE EXHAUST CASE ASSEMBLY - INSTALLATION	
	STRAP, WEBBED (TWO REQUIRED) - - - - -	STANDARD
	STRAP, WEBBED (TWO REQUIRED) - - - - -	PP-1-902
	SLING, HANDLING - - - - -	PWA 6580
	SLING, HANDLING - - - - -	PWA 6580

APPLICABLE SUPPORT EQUIPMENT (continued)

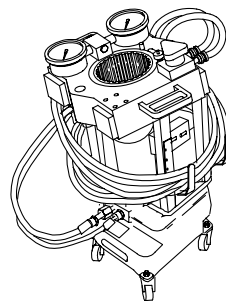
Paragraph	Function - Tool Nomenclature	Tool Number
3	NO. 5 BEARING OUTER RACE AND OUTER RACE RETAINING NUT - INSTALLATION	
	HEATER, TURBINE SHAFT - - - - -	PWA 51932
	DRIFT, NO. 5 BEARING OUTER RACE - - - - -	PWA 57611
	PROTECTOR, NO. 5 BEARING CARBON SEAL - - - - -	PWA 57800
	HOLDER, NO. 5 BEARING OUTER RACE RETAINING NUT - - -	PWA 51960
	WRENCH, NO. 5 BEARING OUTER RACE RETAINING NUT - - -	PWA 51959
	SLING - - - - -	SWE 81001/81002
	TORQUE MULTIPLIER - - - - -	SWE 8100/8200
	WRENCH, HYDRAULIC - - - - -	PWA 50308
4	NO. 5 BEARING SEAL SEAT AND NO. 5 BEARING SEAL SEAT RETAINING NUT - INSTALLATION AND TORQUE PROCEDURE	
	WRENCH, NO. 5 BEARING SEAL SEAT RETAINING NUT - - - -	PWA 53360
	ADAPTER, NO. 5 BEARING SEAL SEAT RETAINING NUT - - -	PWA 56689
		OR
	ADAPTER, NO. 5 BEARING SEAL SEAT RETAINING NUT - - -	PWA 53361
	SLING - - - - -	SWE 81001/81002
	TORQUE MULTIPLIER - - - - -	SWE 8100/8200
	WRENCH, HYDRAULIC - - - - -	PWA 50308
5	NO. 5 BEARING INNER SUPPORT ASSEMBLY AND NO. 5 BEARING INNER RACE AND ROLLERS - INSTALLATION	
	HOLDER, NO. 5 BEARING SEAL - - - - -	PWA 57860
	PUSHER/PULLER NO. 5 BEARING INNER BEARING (PART OF PWA 57883 TOOL SET) - - - - -	PWA 57879
		OR
	PUSHER/PULLER NO. 5 INNER BEARING (PART OF PWA 57658 TOOL SET) - - - - -	PWA 57717
	MAINTENANCE KIT, AIRCRAFT ENGINE FLEXIBLE BORESCOPE RETAINER, FAN DRIVE TURBINE REAR (PART OF PWA 57883 TOOL SET) - - - - -	PWA 56075
		PWA 57824
		OR
	RETAINER ASSEMBLY - - - - -	PWA 57709

ILLUSTRATED SUPPORT EQUIPMENT



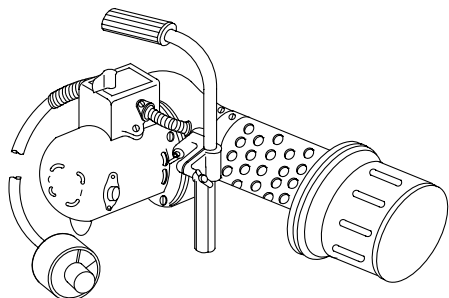
PWA 6580 -C

Figure T1. PWA 6580 SLING



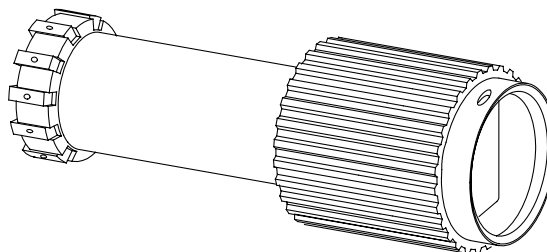
PWA 50308 -C

Figure T2. PWA 50308 WRENCH



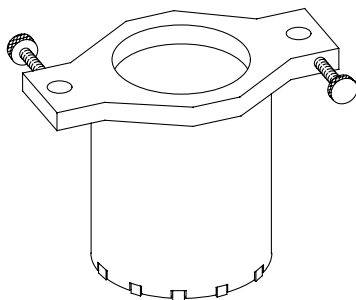
PWA 51932 -C

Figure T3. PWA 51932 HEATER



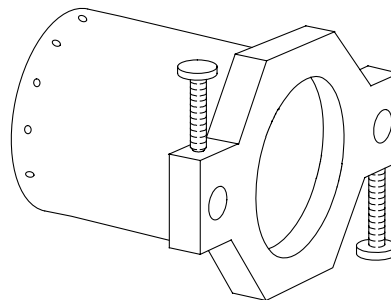
PWA 51959 -C

Figure T4. PWA 51959 WRENCH



PWA 51960 -C

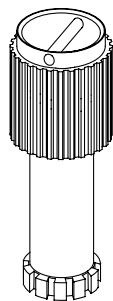
Figure T5. PWA 51960 HOLDER



PWA 53360 -C

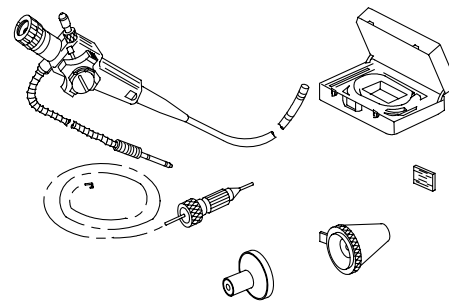
Figure T6. PWA 53360 WRENCH

ILLUSTRATED SUPPORT EQUIPMENT (continued)



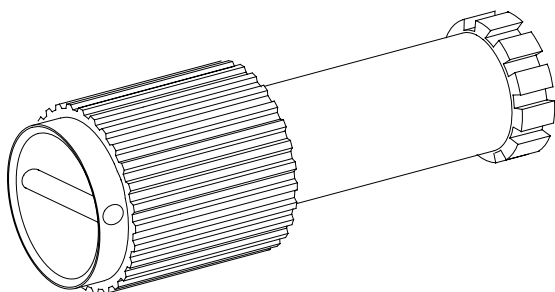
PWA 53361 -C

Figure T7. OF PWA 57658 TOOL SET) ADAPTER



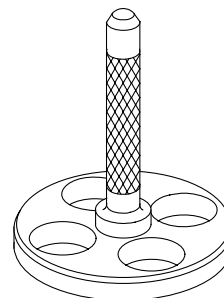
PWA 56075 -C

Figure T8. PWA 56075 MAINTENANCE KIT



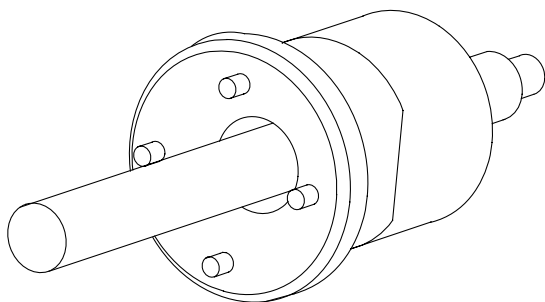
PWA 56689 -C

Figure T9. PWA 56689 ADAPTER



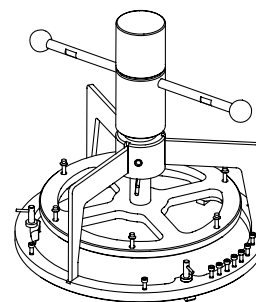
PWA 57611 -C

Figure T10. PWA 57611 DRIFT



PWA 57709 -C

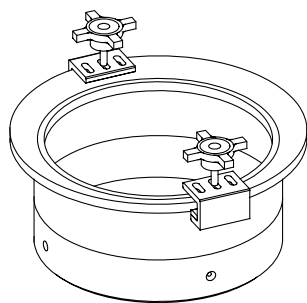
Figure T11. PWA 57709 RETAINER



PWA 57717 -C

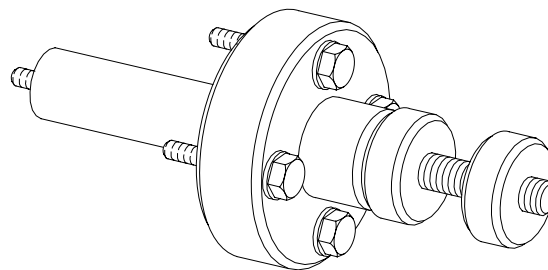
Figure T12. PWA 57717 PUSHER/PULLER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



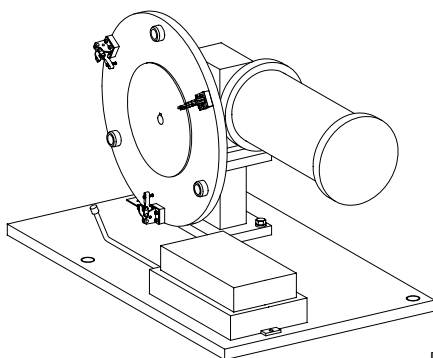
PWA 57800 -C

Figure T13. PWA 57800 PROTECTOR



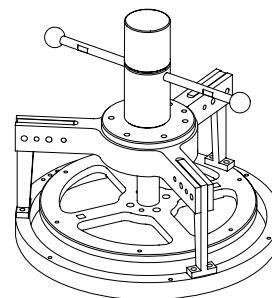
PWA 57824 -C

Figure T14. PWA 57824 RETAINER



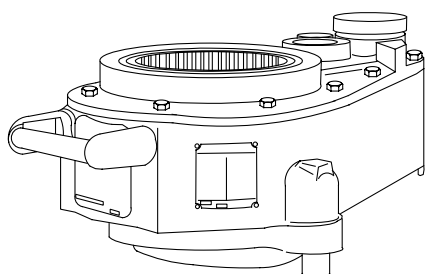
PWA 57860 -C

Figure T15. PWA 57860 HOLDER



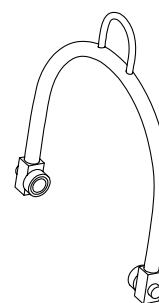
PWA 57879 -C

Figure T16. PWA 57879 PUSHER/PULLER NO. 5 BEARING INNER BEARING TORQUE MULTIPLIER



SWE 8200 -C

Figure T17. SWE 8100/8200 TORQUE MULTIPLIER



SWE 81002 -C

Figure T18. SWE 81001/81002 SLING

1. INTRODUCTION.

- a. This work package contains instructions for final assembly of fan drive turbine module. The following components are installed:
 - Turbine exhaust case assembly
 - No. 5 bearing outer race
 - No. 5 bearing seal seat
 - No. 5 bearing inner support assembly and inner race and rollers

2. TURBINE EXHAUST CASE ASSEMBLY - INSTALLATION.

(See Figures 1, 1A, and 1B.)



Failure to install correct turbine exhaust case configuration to front compressor drive turbine and rotor assembly will cause engine damage or failure.

- a. Determine correct turbine exhaust case configuration using both of the following two methods:
 - (1) Measure turbine exhaust front duct overall length (see figure 1). For 4th stage turbine rotor assemblies with 60 blades, dimension(1) shall be 2.565 to 2.625 inches; 4th stage turbine rotor assemblies with 66 blades, dimension(1) shall be 2.865 to 2.925 inches.

- (2) Identify air seal configuration (see figure 1). Turbine exhaust cases with brush seal and support assembly attached must be used with 60 blade 4th stage turbine rotor assemblies incorporating 4th stage turbine air sealing ring (see figure 1A).

- b. Refer to T.O. 2J-F100-54 if configuration is not correct. Disassemble turbine exhaust case assembly per WP 024 00. Reassemble using the correct parts per WP 609 00.

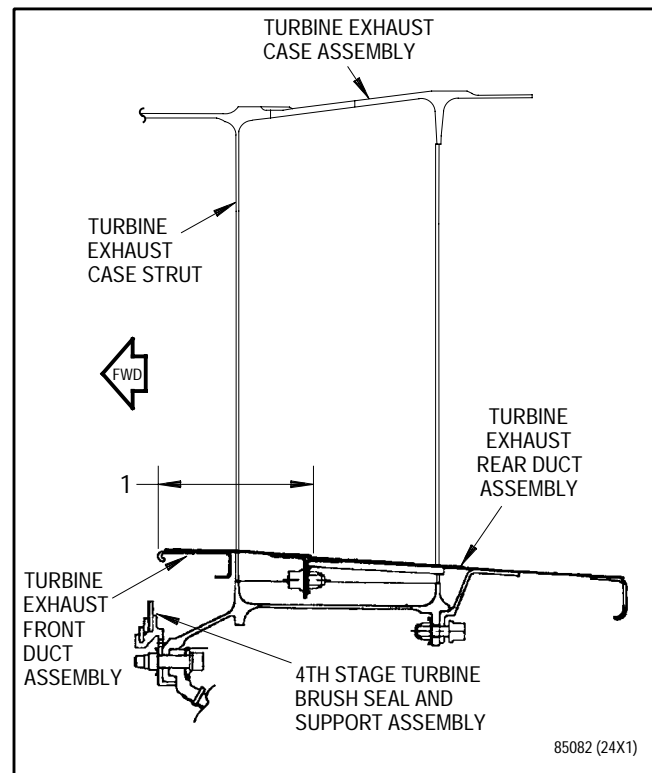


Figure 1. Turbine Exhaust Case Assembly - Verification

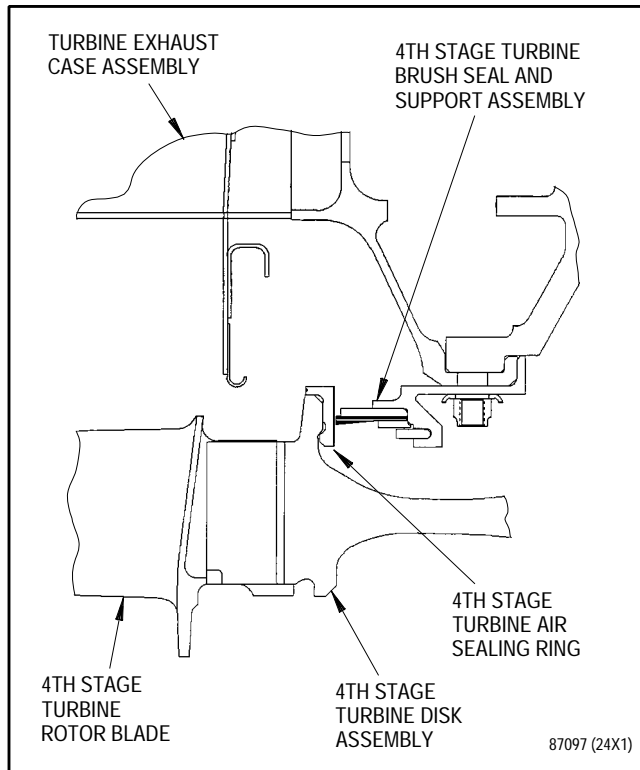


Figure 1A. Fourth Stage Turbine Brush Seal and Support Assembly and Fourth Stage Turbine Air Sealing Ring - Configuration

NOTE

Optional method of removing turbine exhaust case using two(2) people, lifting at struts, is acceptable.

- c. Loop two PP-1-902 web straps around two struts of turbine exhaust case assembly, 180 degrees apart (See figure 1B).
- d. Connect PWA 6580 sling and an overhead hoist to straps, then raise turbine exhaust case assembly into position over front compressor drive turbine rotor and stator.
- e. If necessary, remove protective cover from rear of turbine case.

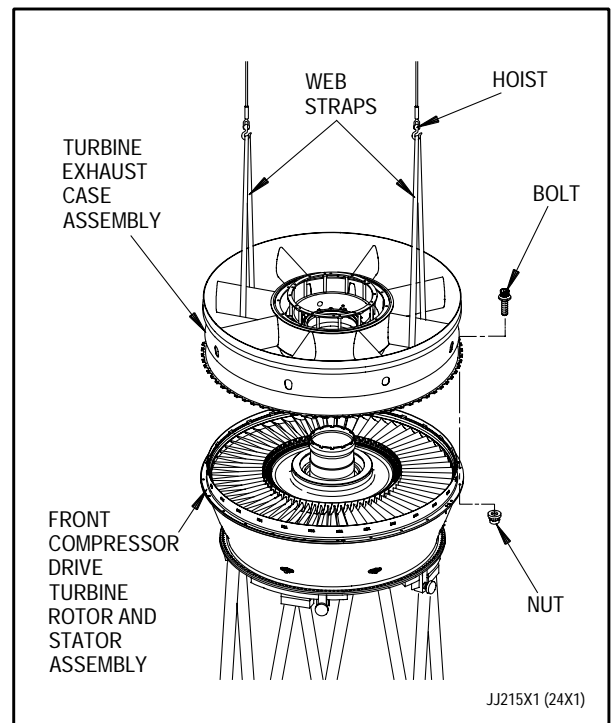


Figure 1B. Turbine Exhaust Case Assembly - Installation

- f. Align dowel pin and dowel pin hole at 6 o'clock position on flanges and carefully lower turbine exhaust case onto rotor and stator.
- g. Remove tooling.
- h. Lubricate threads of bolts and nut face with PWA 36053-3 antiseize compound.
- i. Install bolts, head rearward, and nuts. Leave four boltholes vacant at three and nine o'clock positions. Torque bolts 32 to 36 pound-inches.

3. NO. 5 BEARING OUTER RACE AND OUTER RACE RETAINING NUT - INSTALLATION.

(See Figure 2.)

- a. Install PWA 51932 heater inside turbine shaft. Turn on heater and heat area where No. 5 bearing outer race will be installed at 280° to 300°F (138° to 149°C) for 10 to 15 minutes. Use a standard 0° to 800°F pyrometer to measure temperature.
- b. Remove PWA 51932 heater.

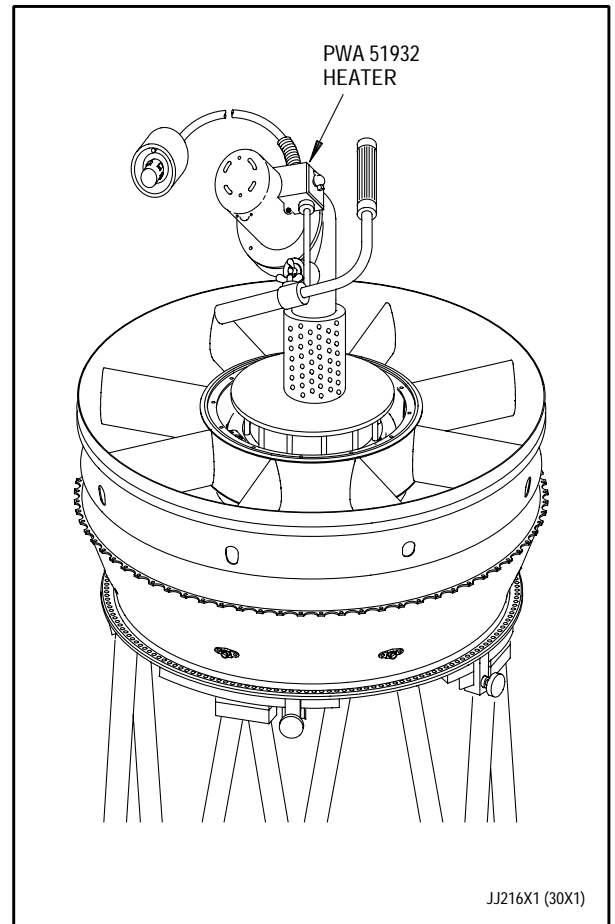


Figure 2. No. 5 Bearing Outer Race and Outer Race Retaining Nut - Installation (Sheet 1 of 4)

- c. Install No. 5 bearing outer race with serial number facing up into turbine shaft ID.
- d. Seat No. 5 bearing outer race against plug using PWA 57611 drift and a fiber mallet.
- e. Coat ID threads of turbine shaft with Fel-Pro C-300 antigalling compound.
- e1. Install PWA 57800 No. 5 bearing carbon seal protector as follows: (See figure 2, sheet 3.)
 - (1) Secure clamps in outboard position using hand knobs.
 - (2) Align four slots in base of protector with four carbon seal guide pins.
 - (3) Carefully insert protector into seal support until it contacts support rear flange.
 - (4) Hold protector against support flange and secure support flange clamps inboard using hand knobs.

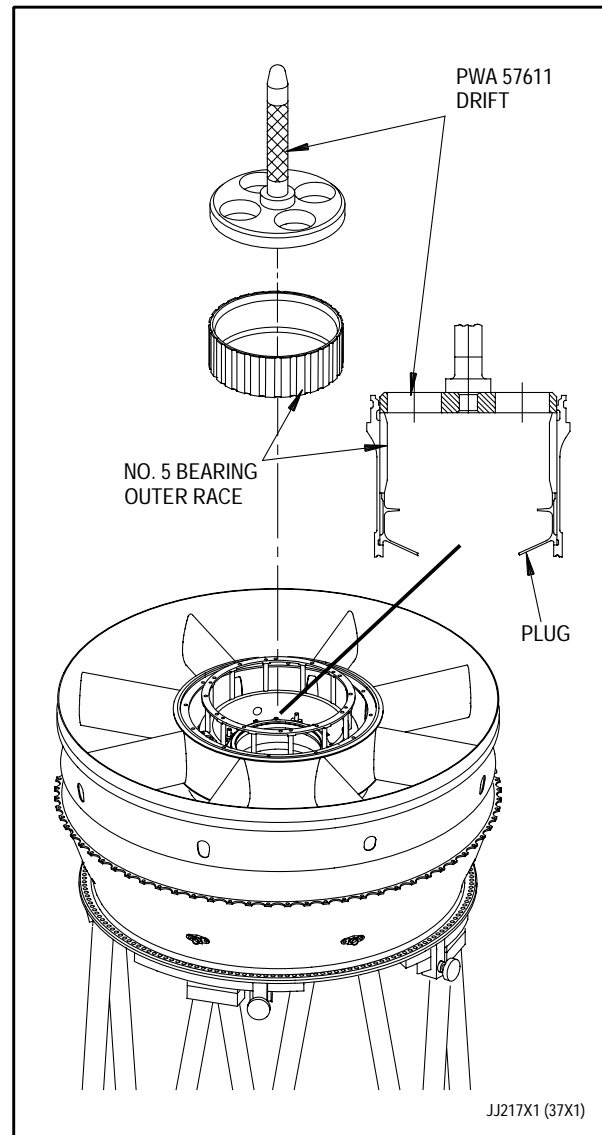


Figure 2. No. 5 Bearing Outer Race and Outer Race Retaining Nut - Installation (Sheet 2 of 4)

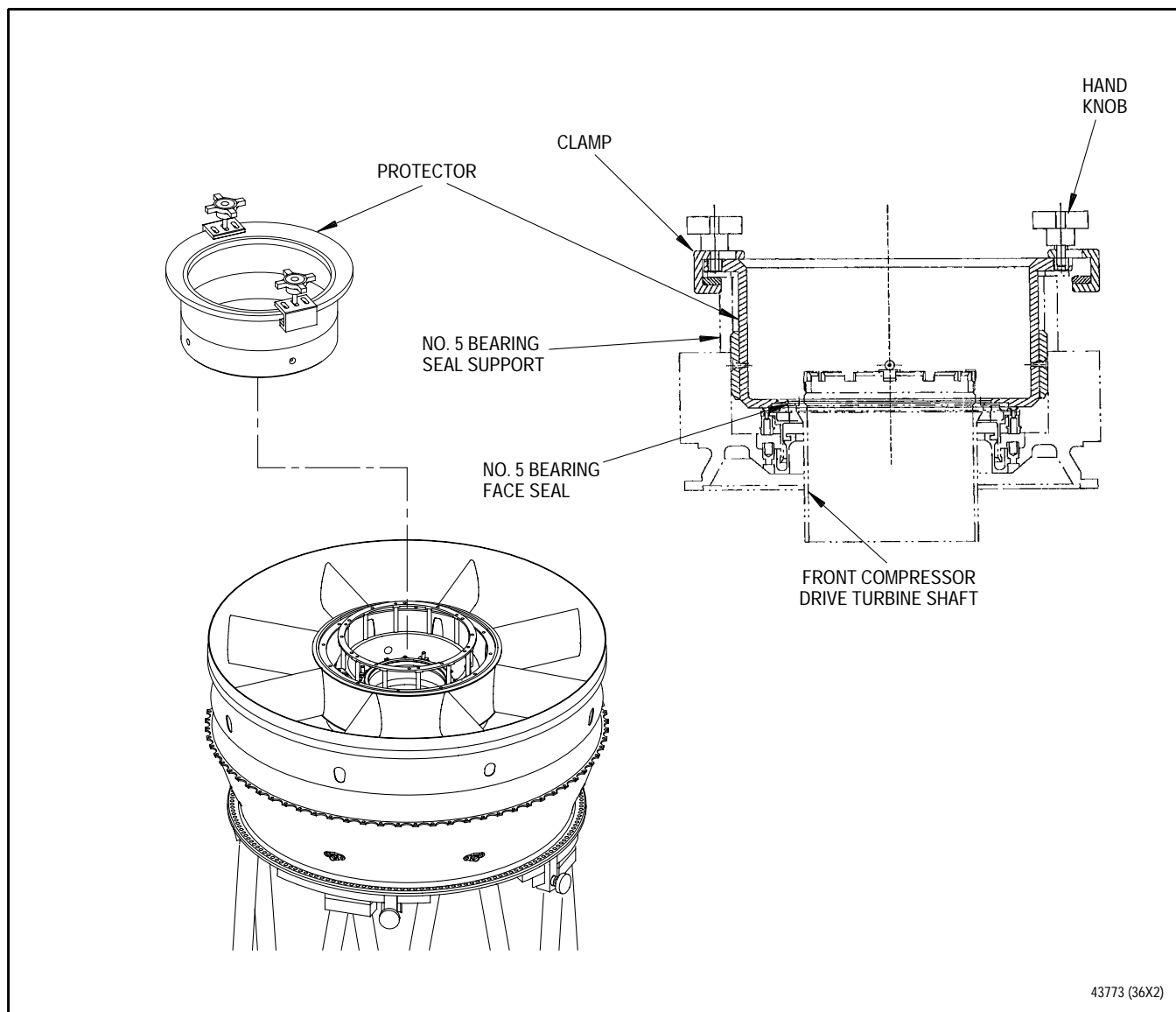


Figure 2. No. 5 Bearing Outer Race and Outer Race Retaining Nut - Installation (Sheet 3 of 4)

NOTE

No. 5 bearing retaining nut has a left-hand thread. Turn nut counterclockwise to install.

- f. Install retaining nut on turbine shaft handtight.
- g. Install PWA 51960 holder ensuring lugs engage slots of turbine shaft.
- h. Install PWA 51959 wrench ensuring that lugs at bottom engage slots in No. 5 bearing outer race retaining nut.

NOTE

SWE 81001/81002 sling may be used to handle SWE 8100/8200 torque multiplier.

- i. Install PWA 50308 hydraulic wrench or SWE 8200/8100 torque multiplier so that it fits onto splines of PWA 51959 wrench. Engage dowel pins on body of hydraulic wrench or torque multiplier with holes at top of PWA 51960 holder. Tighten thumbscrews to secure. If torque multiplier is used, install ratchet adapter and torque wrench.
- j. If hydraulic wrench is used, set shift knob to actuate splines in a counterclockwise direction. Hold body of wrench so that splines will turn to tighten nut in a counterclockwise direction.



Failure to ensure proper rotational direction of hydraulic wrench before use may result in over torque on retaining nut causing damage to engine components.

- k. Torque nut as follows:

NOTE

Refer to T.O. 32B14-5-2-1 for PWA 50308 hydraulic wrench operating instructions. Refer

to T.O. 32A5-2-2-1 for SWE 8200/8100 torque multiplier operating instructions.

- (1) Actuate wrench or torque multiplier to torque nut 2000 to 2200 pound-inches.
- (2) Set zero mark on hydraulic wrench or torque multiplier protractor.
- (3) Further tighten nut by turning through an angle of 16 to 20 degrees.
- (4) Loosen nut to zero torque.
- (5) Torque nut 2000 to 2200 pound-inches.
- (6) Turn nut through an angle of 16 to 20 degrees.
- (7) If required, reset zero mark on hydraulic wrench or torque multiplier protractor.
- (8) Loosen nut to zero torque.
- (9) Torque nut 2000 to 2200 pound-inches.
- (10) Check if 0 degree mark on ratchet is in line with 0 degree mark on protractor or beyond it within 2 degrees maximum.
- (11) If 0 degree marks are not aligned within limits, repeat steps (6) through (8).
- (12) If 0 degree marks are aligned within limits, turn nut through an angle of 16 to 20 degrees.

- l. Remove tooling.

- m. Remove PWA 57800 protector as follows:

- (1) Secure clamps in outboard position using hand knobs.
- (2) Carefully remove protector from seal support.

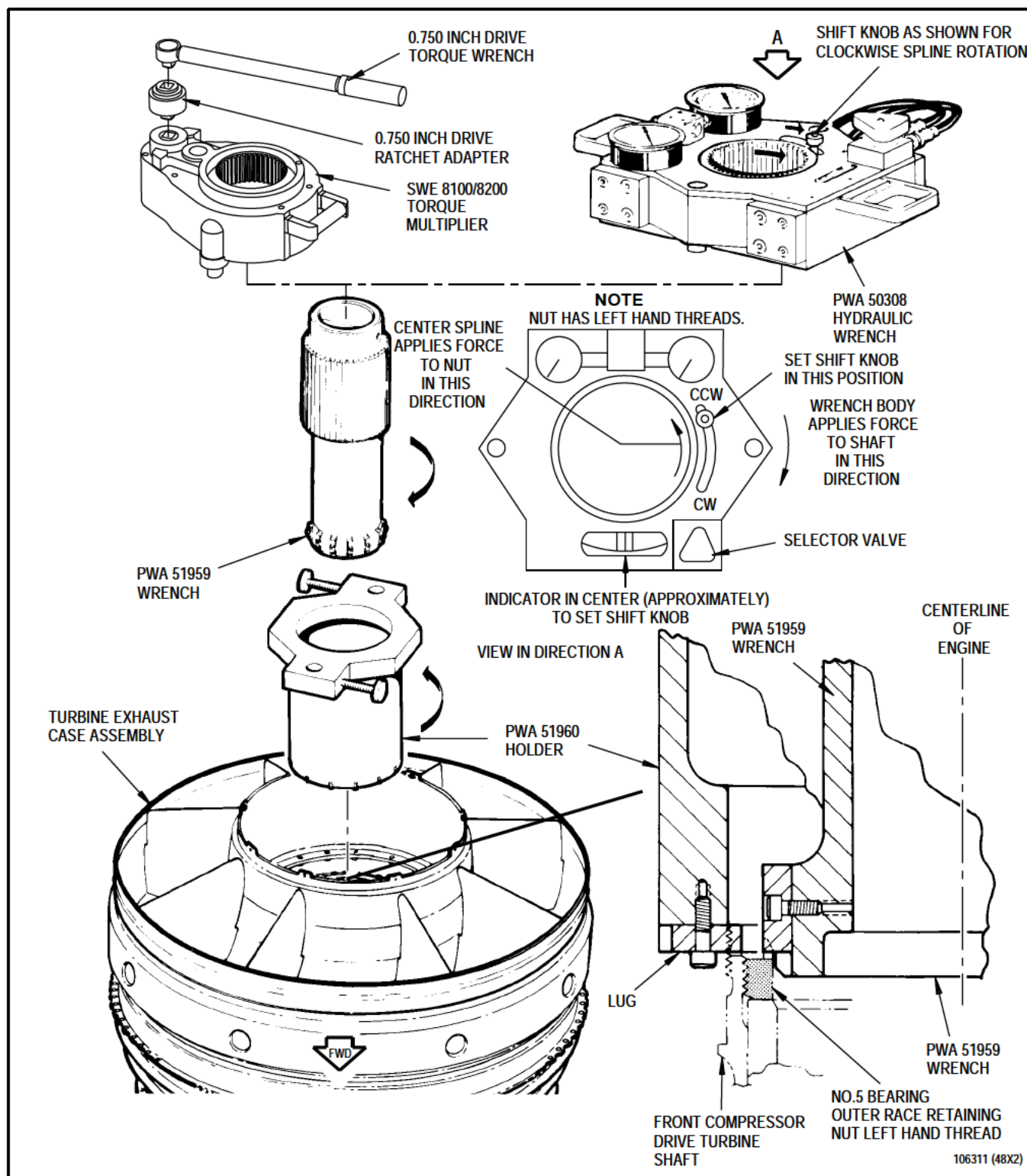


Figure 2. No. 5 Bearing Outer Race and Outer Race Retaining Nut - Installation (Sheet 4 of 4)

3A. NO. 5 BEARING - MEASUREMENT OF PARTS BEFORE INSTALLATION

(See Figure 2A.)

- a. Measure parts in figure 2A as follows:
 - (1) Distance from end of front compressor drive to seal seat lip.
 - (2) Thickness of No. 5 bearing seal seat.
 - (3) Thickness of No. 5 bearing seal seat retaining nut.
- b. Measurements will be used to check seating of parts after No. 5 bearing is installed.
- c. Part identification: parts to be measured before installing No. 5 bearing.
 - (1) Determine distance A, distance from rear end of front compressor drive shaft to rear face of No. 5 seal seat lip.

- (2) Determine dimension B, thickness of No. 5 bearing seal seat. Take three measurements equally spaced and average them.
- (3) Determine dimension C, thickness of No. 5 bearing seal seat retaining nut. Take three measurements equally spaced and average them.
- (4) Add dimension B and C to get dimension D.
Example: $B + C = D$
- (5) Subtract dimension A from dimension D to get dimension E.
Example: $D - A = E$
Dimension E will be used to check seating of parts after No. 5 bearing is installed.

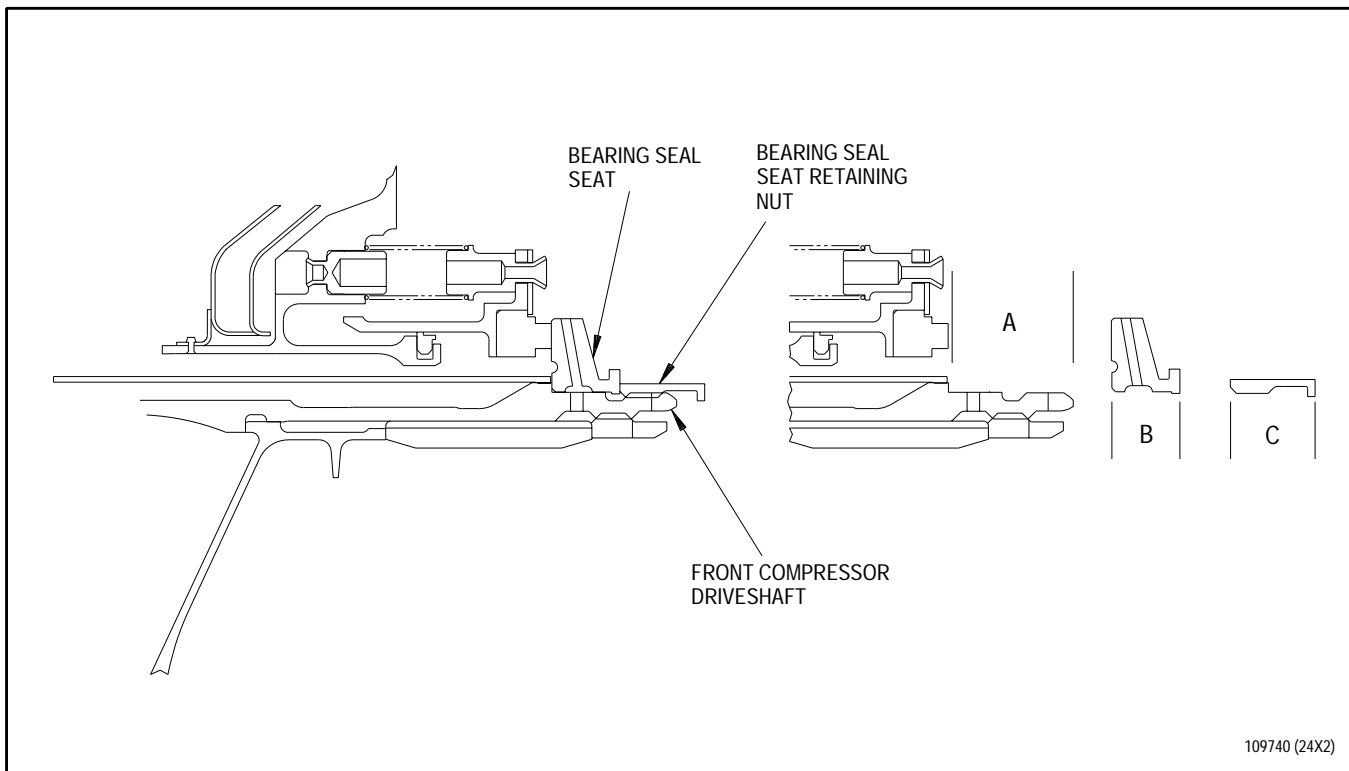


Figure 2A. No. 5 Bearing - Measurement Of Parts Before Installation

4. NO. 5 BEARING SEAL SEAT AND NO. 5 BEARING SEAL SEAT RETAINING NUT - INSTALLATION AND TORQUE PROCEDURE.

(See Figure 3.)



If heat shield is not forward of heat seal lip, improper seal seat seating and turbine failure may result.

- a. Ensure that No. 5 bearing heat shield is forward of (below) seal seat lip on turbine shaft before installation of bearing assembly (see figure 3, sheet 3 of 3). Reinstall heat shield if heat shield is improperly positioned.
- b. Remove seal seat from oil tank and install, puller groove up, over turbine shaft.
- c. Coat threads of No. 5 bearing seal seat retaining nut with MIL-L-7808 lubricating oil.
- d. Install No. 5 bearing seal seat retaining nut on turbine shaft, handtight.
- e. Install PWA 53360 wrench ensuring that lugs at bottom of wrench engage slots in No. 5 bearing seal seat retaining nut.
- f. Install PWA 56689 adapter ensuring that lugs at bottom of adapter engage slots in turbine shaft.

NOTE

SWE 81001/81002 sling may be used to handle SWE 8100/8200 torque multiplier.

- g. Install PWA 50308 hydraulic wrench or SWE 8100/8200 torque multiplier aligning splines of adapter. Engage dowel pins on body of hydraulic wrench or torque multiplier with holes at top of wrench. Secure by tightening thumbscrews. If torque multiplier is used, install ratchet adapter and torque wrench.

NOTE

- Body of hydraulic wrench or torque multiplier moves to turn PWA 53360 wrench in a clockwise direction.
- Splines of hydraulic wrench or torque multiplier do not turn. However, force is applied in a counterclockwise direction.
- PWA 56689 adapter does not turn. However, force is applied in a counterclockwise direction.
- h. If hydraulic wrench is used, set shift knob for counterclockwise spline rotation.

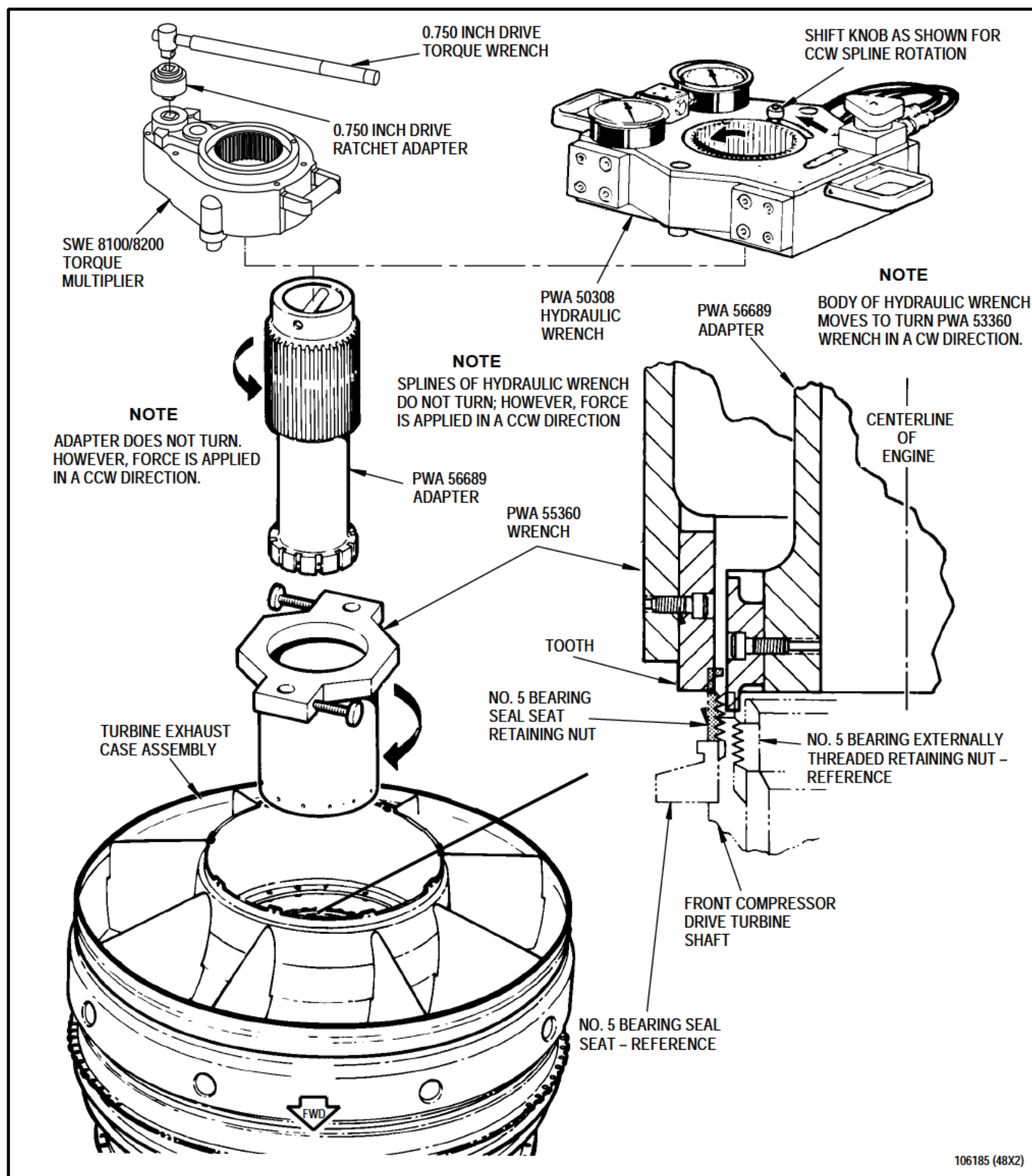


Figure 3. No. 5 Bearing Seal Seat and No. 5 Bearing Seal Seat Retaining Nut - Installation (Sheet 1 of 3)

i. Torque nut as follows:

NOTE

Refer to T.O. 32B14-5-2-1 for PWA 50308 hydraulic wrench operating instructions. Refer to T.O. 32A5-2-2-1 for SWE 8100/82100 torque multiplier operating instructions.

- (1) Actuate wrench or torque multiplier to torque nut 1350 to 1500 pound-inches.
- (2) Further tighten nut by turning through an angle of 3 to 6 degrees.
- (3) Remove tooling.

NOTE

There are two configurations No. 5 bearing roller guide:

- One incorporating locking tabs and used with a retaining ring. (See step j.)
- One not incorporating locking tabs and used with a key washer. (See step k.)

j. For assemblies incorporating No. 5 bearing roller guide with locking tabs, install roller guide and retaining ring as follows:

- (1) Compress guide to close vertical slot.



Failure to properly install bearing roller guide can lead to bearing area fire and catastrophic engine failure.

- (2) Install guide, tapered end down, aligning inner tabs with slots in No. 5 bearing outer race retaining nut and outer tabs with slots in seal seat retaining nut.
- (3) Install edge of guide into groove under lip of seal seat retaining nut. Working around, force guide under lip of nut. Ensure guide is fully seated (360 degrees) under lip of nut.
- (4) Install retaining ring into groove under lip of seal seat retaining nut. Ensure ring is fully seated under lip of nut.

k. For assemblies incorporating No. 5 bearing roller guide without locking tabs, install key washer and roller guide as follows:

- (1) Install key washer aligning inner tabs with slots in No. 5 bearing outer race retaining nut and outer tabs with slots in seal seat retaining nut.
- (2) Compress guide to close vertical slot.



Failure to properly install bearing roller guide as specified may result in bearing area fire and/or engine failure.

- (3) Install No. 5 bearing roller guide, tapered end down.

- (4) Install edge of guide into groove under lip of seal seat retaining nut. Working around, force roller guide under lip of retaining nut.

- (5) Ensure guide is fully seated (360 degrees) under lip of seal seat retaining nut by rotating guide by hand. If guide is not free to rotate, it is not fully seated.

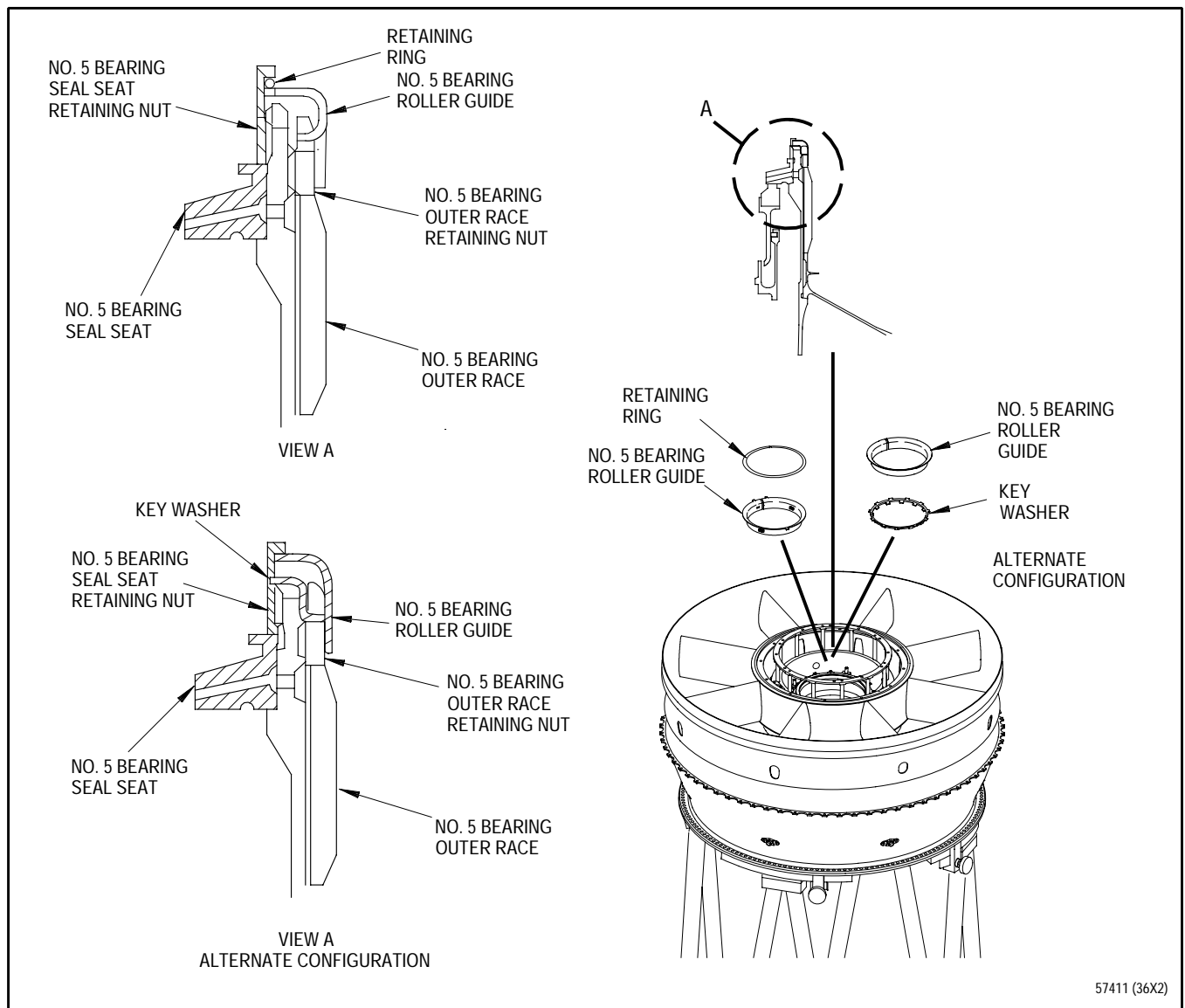


Figure 3. No. 5 Bearing Seal Seat and No. 5 Bearing Seal Seat Nut - Installation (Sheet 2 of 3)

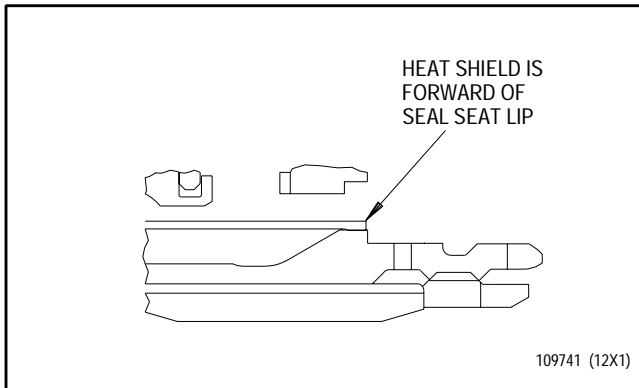


Figure 3. No. 5 Bearing Seal Seat and No. 5 Bearing Seal Seat Nut - Installation (Sheet 3 of 3)

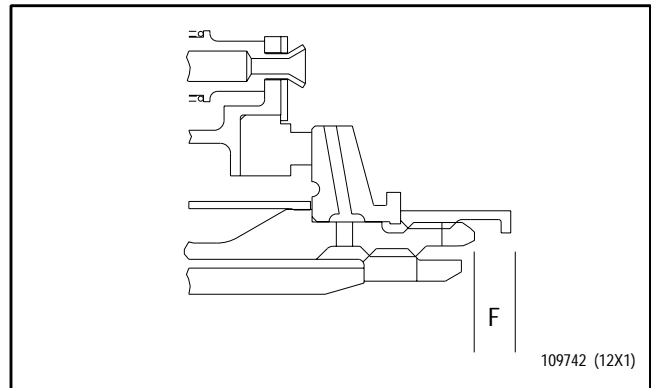


Figure 3A. No. 5 Bearing Assembly - Seating Check

4A. NO. 5 BEARING ASSEMBLY - SEATING CHECK

(See Figure 3A.)

- a. Measure distance from rear face of No. 5 bearing seal retaining nut to rear face of front compressor drive shaft. See figure 3A.
- b. Compare to value from step 5a to ensure correct seating of No. 5 bearing assembly.
 - (1) Determine dimension F, distance from rear face of No. 5 bearing seal retaining nut to rear end of front compressor drive shaft.
 - (2) Compare dimension F with dimension E (from para 3A, step (5)). Dimension F should be equal to dimension $E \pm 0.001$ inch.

5. NO. 5 BEARING INNER SUPPORT ASSEMBLY AND NO. 5 BEARING INNER RACE AND ROLLERS - INSTALLATION.

(See Figure 4.)

NOTE

Two methods for installation of seals onto No. 5 bearing inner support exist. One method uses PWA 57860 holder, the other installs seals with support assembly on workbench.

- a. Install seals onto No. 5 bearing inner support assembly using PWA 57860 holder as follows:

- (1) Secure No. 5 bearing inner support assembly to PWA 57860 holder as follows:



Failure to ensure fixture status is correct may result in damage to fixture and/or engine parts.

- (a) Ensure PWA 57860 holder is unplugged, both switches are in OFF position and variable speed controller dial is set to ZERO before use.
- (b) Retract three toggle clamps, allowing installation of support assembly.
- (c) Locate flange face of support assembly against holding plate and secure by actuating toggle clamps.
- (2) Install seals onto No. 5 bearing inner support assembly as follows:

- (a) Position seal kit holder over support assembly. Allow bottom seal ring groove to remain exposed. (See figure 4, sheet 1.)



Failure to install seals and back-up rings in proper order may result in engine damage.

NOTE

Bottom seal is not installed with a corresponding back-up ring.

- (b) Carefully slide bottom seal off seal kit holder and into bottom seal ring groove of support assembly. Ensure seals and back-up rings are installed in correct order.



Failure to ensure seals were not rolled or twisted during installation may result in engine damage.

- (c) Ensure seal is not rolled or twisted in seal ring groove.
- (d) Position seal kit holder so middle seal ring groove is exposed. (See figure 4, sheet 1.)
- (e) Carefully slide middle seal and back-up ring off seal kit holder and into middle seal ring groove of support assembly.
- (f) Ensure seal and back-up ring is not rolled or twisted in seal ring groove.

- (g) Position seal kit holder so top seal ring groove is exposed.
(See figure 4, sheet 1.)
- (h) Carefully slide top seal and back-up ring off seal kit holder and into top seal ring groove of support assembly.
- (i) Ensure seal and back-up ring is not rolled or twisted in seal ring groove.
- (j) Remove and return seal kit holder to supplier.

(3) Heat shrink seals as follows:



Failure to ensure holder is set as specified may result in damage to hardware.

- (a) Ensure both PWA 57860 holder switches are in OFF position and variable speed controller dial is set to ZERO position.
- (b) Insert power cord into appropriate electrical outlet, turn both switches ON at control box, turn variable speed control dial until a safe/comfortable working rotation (6 to 10 rpm) is achieved.



Failure to heat seals properly during shrink procedure will result in seal damage.

- (c) Hold heat gun, PWA 51932 or equivalent, 3 to 6 inches from rotating No. 5 bearing inner support assembly while heating.
- (d) Heat seals to 300°F to 450°F (149°C to 232°C) for 20 to 30 minutes.
- (e) Continuously rotate support assembly during heating procedure and ensure seals are properly seated in seal ring grooves.

NOTE

Seals will continue to shrink while cooling. Seals are considered properly shrunk when they fit snugly in seal ring grooves.

- (4) Allow support assembly and seals to continue to rotate in fixture until assembly has cooled to room temperature.
- (5) Shut down system by rotating variable speed controller dial to ZERO position, turn OFF both switches and unplug. Remove bearing support by retracting toggle clamps.

a1. Install seals onto No. 5 bearing inner support assembly using workbench method, proceed as follows:

- (1) Place No. 5 bearing inner support assembly on workbench or equivalent with seal ring grooves facing up. (See figure 4, Sheet 1.)



Failure to install seals and back-up rings as specified may result in damage.

- (1a) Ensure seals and back-up rings are installed in same position as mounted on seal kit holder. Do not remove seals and back-up rings from seal kit holder.

NOTE

First seal to be installed does not have a back-up ring.

- (2) Position seal kit holder down over No. 5 bearing inner support assembly. Allow bottom seal ring groove to remain exposed.
- (3) Ensure seals and back-up rings do not roll during installation. Carefully slide bottom seal off seal kit holder and into bottom seal ring groove of support assembly.
- (4) Ensure seal is not rolled or twisted in seal ring groove.
- (5) Position seal kit holder so middle seal ring groove is exposed.

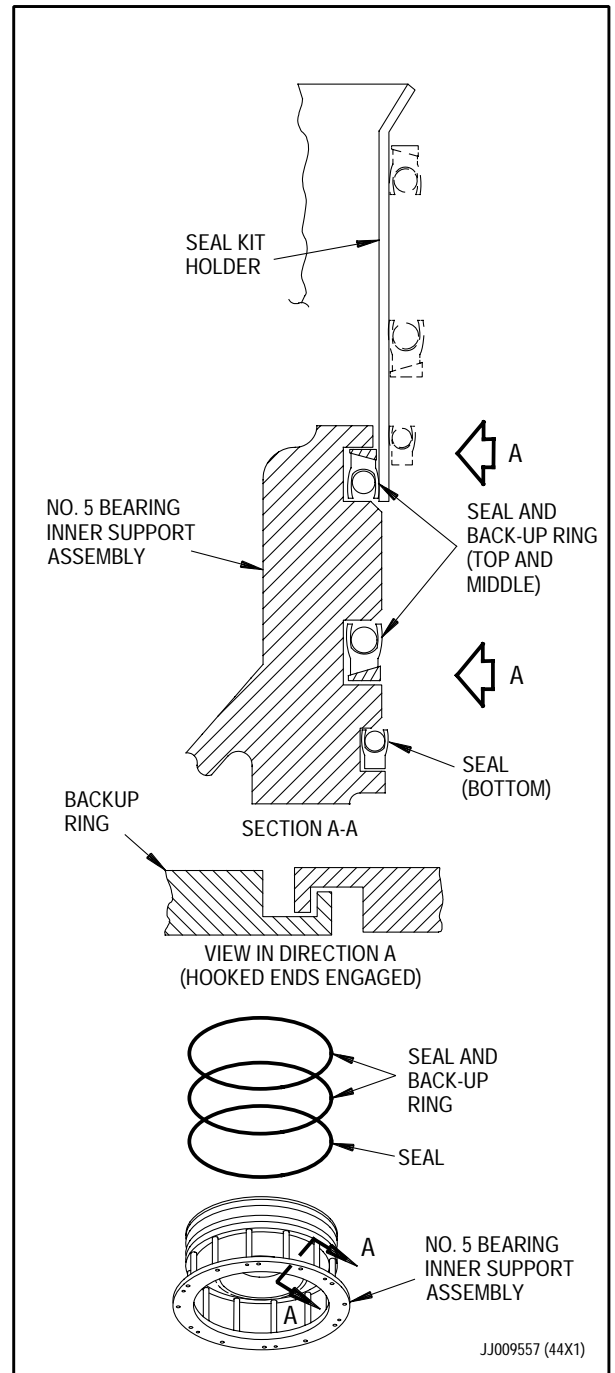


Figure 4. No. 5 Bearing Inner Race and Rollers - Installation (Sheet 1 of 5)

- (6) Carefully slide middle seal and back-up ring off seal ring holder and into middle seal ring groove of support assembly.
- (7) Ensure seal and back-up ring is not rolled or twisted in seal ring groove.
- (8) Position seal kit holder so top seal ring groove is exposed.
- (9) Carefully slide top seal and back-up ring off seal ring holder and into top seal ring groove of support assembly.
- (10) Ensure seal and back-up ring is not rolled or twisted in seal ring groove.
- (11) Remove seal kit holder. Retain seal kit holder for return to vendor.



Use of proper heat during seal shrink procedure is important. Seals cannot be further shrunk after they have cooled to room temperature.

NOTE

Two technicians are required to perform seal shrink procedure. One technician applies heat to assembly, while second technician rotates assembly and guides seals into seal ring grooves.

- (12) Heat shrink seals as follows:
 - (a) Hold standard heat gun 6 to 8 inches from No. 5 bearing inner support assembly while heating.
 - (b) Heat seals 300° to 450°F (149° to 232°C) for 20 to 30 minutes.
 - (c) Continuously rotate support assembly during heating procedure and ensure seals are properly seated in seal ring grooves.

NOTE

Seals will continue to shrink while cooling. Seals are considered properly shrunk when they fit snugly in seal ring grooves.

- (13) Allow support assembly and seals to cool to room temperature.
 - (14) Lock back-up rings on top and middle seals by compressing and hooking end together.
- b. Lubricate seals with MIL-L-7808 lubricating oil.
 - c. Coat bearings on inner support and outer race in ID of turbine shaft with MIL-L-7808 lubricating oil.

d. Adjust PWA 57879 pusher/puller to uppermost travel. (See figure 4, Sheet 2.)

e. Install PWA 57879 pusher/puller to inner support as follows:

- (1) Lower pusher/puller over inner support lining up first threaded hole clockwise from TDC in inner support assembly with hole marked TOP in detail-14 of pusher/puller. Non-threaded hole in part should appear in sight on pusher/puller when tool is properly located.

- (2) Tighten detail-23 screws until seated.



If bearing rollers sag outward, damage to bearing can result.

f. Pack No. 5 bearing roller and cage with PWA 36500 lubricant to retain roller positioning. Ensure No. 5 bearing rollers are pushed inward into bearing cage during installation of inner support assembly. If bearing rollers sag outward, damage to bearing can result.

f1. Carefully lower support and pusher/puller, aligning bearing, support, and pusher/puller flange with exhaust case flange. Ensure hole marked TOP in detail-1 of PWA 57879 is aligned with TDC hole of turbine exhaust case.

g. Tighten detail-22 screws until seated.

h. Using care, gradually turn handle to install No. 5 bearing inner support assembly into No. 5 bearing seal assembly. Use hole marked SIGHT on detail-14 to aid visually, in aligning mating holes in flanges.

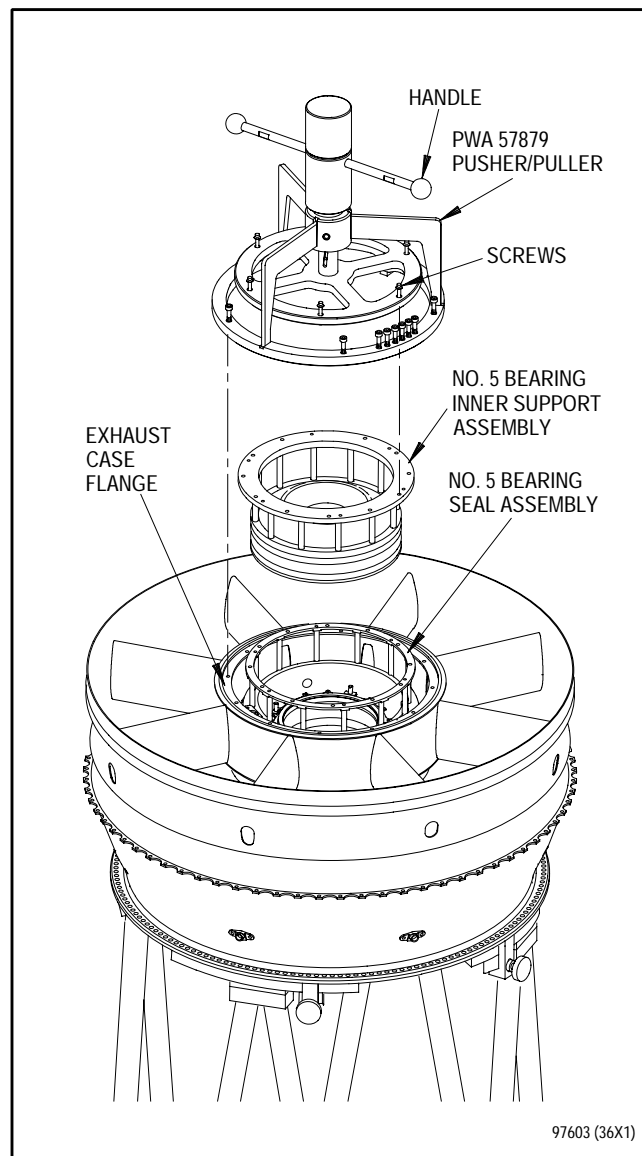


Figure 4. No. 5 Bearing Inner Support Assembly and No. 5 Bearing Inner Race and Rollers - Installation (Sheet 2 of 5)

WARNING

Do not place fingers under pusher/puller. The No. 5 bearing can get hung up on shaft during assembly and removal and become falling hazard during tool removal.

- i. Remove PWA 57879 pusher/puller.
- il. Inspect No. 5 bearing roller and cage positioning using PWA 56075 maintenance kit. Refer to T.O. 2J-F100-53-5, WP 021 00 for PWA 56075 maintenance kit operating instructions.
- (1) Insert PWA 56075 fibrescope through No. 5 bearing inner support oil jet opening. Bend fibrescope greater than 90° to view No. 5 bearing. See figure 4, sheet 3.
- (2) Ensure No. 5 bearing roller and cage are properly positioned, contacting outer bearing race approximately mid-length. If roller are not visible contacting outer race, remove inner support for inspection.
- j. Install 12 work bolts and nuts in bolts holes in inner support and seal assembly mating flanges.

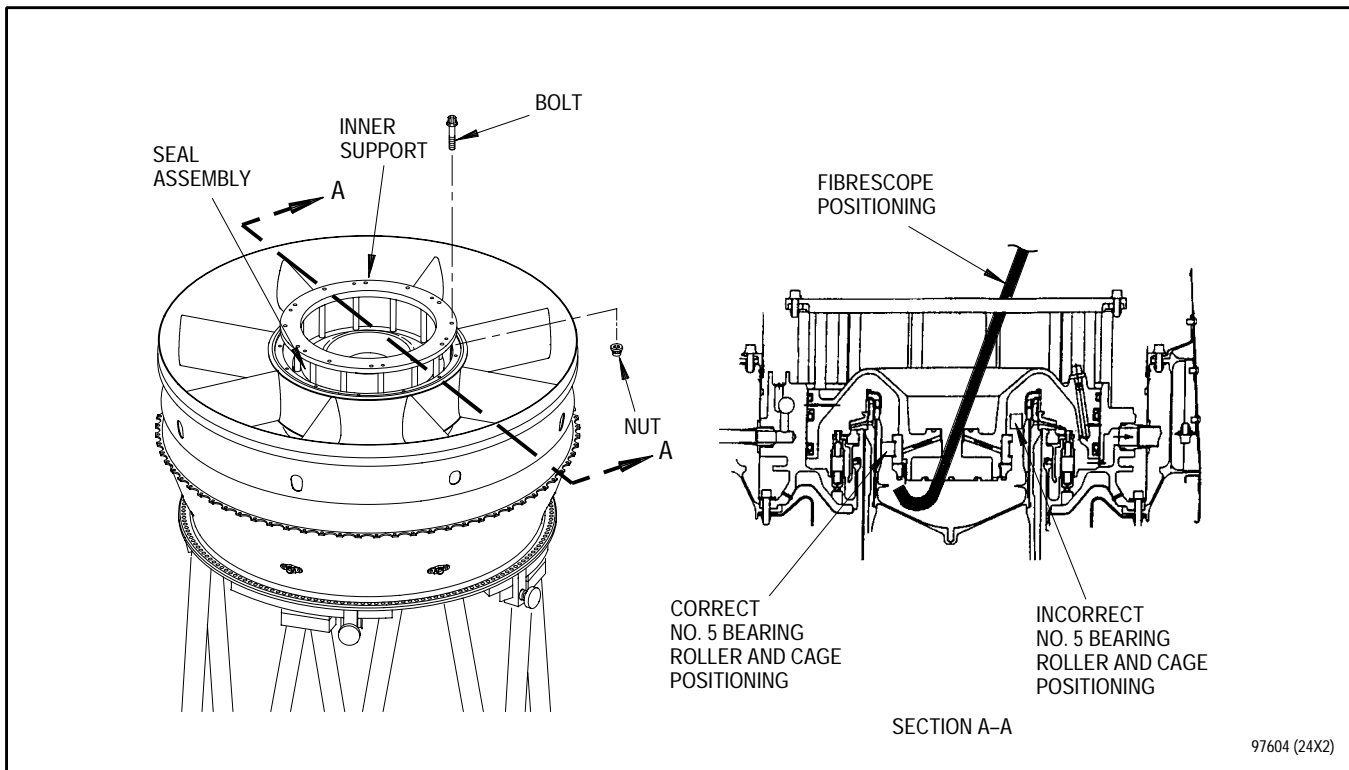


Figure 4. No. 5 Bearing Inner Race and Rollers - Installation (Sheet 3 of 5)

- k. Torque bolts 10 to 15 pound-inches in sequence (see figure 4, Sheet 4).
- l. Further torque bolts 27 to 30 pound-inches in same sequence to seat flanges.
- m. Remove work bolts and nuts.
- n. Lubricate threads of bolts with PWA 36053-3 antiseize compound.
- o. Install bolts and nuts.
- p. Torque bolts 10 to 15 pound-inches in sequence. (See figure 4, Sheet 4.)
- q. Further torque bolts 27 to 30 pound-inches in same sequence.

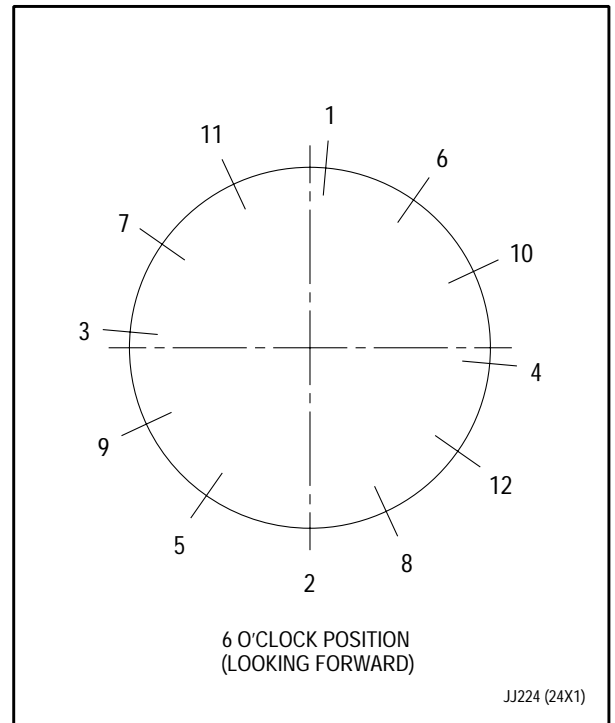


Figure 4. No. 5 Bearing Inner Race and Rollers - Installation (Sheet 4 of 5)

NOTE

Turbine rotor axial position may be secured using either PWA 57824 retainer per step r. or PWA 57709 retainer per step s.

r. Install PWA 57824 retainer as follows: (See figure 4, Sheet 5.)

- (1) Rotate knurled nut and handle counterclockwise on shaft toward knurled knob end of shaft.
- (2) Thread shaft into No. 5 bearing plug until shaft bottoms. Back off 1/4 to 1/2 turn.
- (3) Rotate handle clockwise on shaft until it contacts No. 5 bearing inner support assembly. Secure with four screws.
- (4) Handtighten knurled nut against handle.

s. Install PWA 57709 retainer as follows: (See figure 4, Sheet 5.)

- (1) Thread PWA 57709 retainer detail-1 shaft into No. 5 bearing plug until shaft bottoms. Back shaft off 1/4 to 1/2 turn.
- (2) Slide detail-2 base over shaft and seat base on No. 5 bearing inner support assembly, aligning holes.
- (3) Secure detail-2 base with detail-4 screws.
- (4) Thread detail-3 handle onto detail-2 base handtight.
- (5) Thread detail-3 handle an additional 1/3 turn with wrench.

t. Install protective cover over fan drive turbine module.

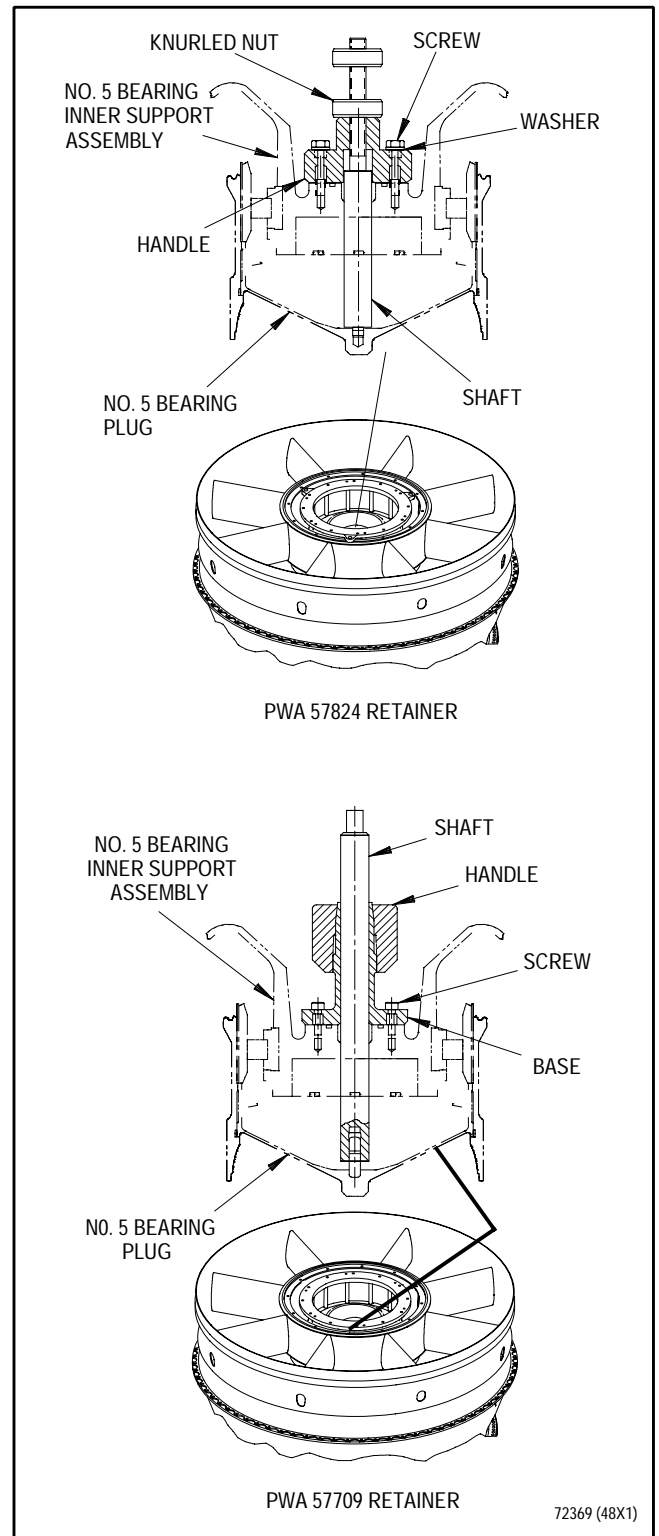


Figure 4. No. 5 Bearing Inner Race and Rollers - Installation (Sheet 5 of 5)

72369 (48X1)

6. FOLLOW-ON MAINTENANCE.

- a. Perform No. 5 bearing compartment airflow check and vacuum check per WP 702 00.

WORK PACKAGE**TECHNICAL PROCEDURES****COMPARTMENT, NO. 5 BEARING -****AIRFLOW AND VACUUM CHECKS,
DAMPER SEALS LEAK CHECK****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 18

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1	20	9 - 10	19	12 - 16	19
2	19	11	20	17 Added	19
3 - 8	20			18 Blank Added	19

REFERENCE MATERIAL REQUIRED

Title	Number
Introduction and General Information - - - - -	T.O. 2J-F100-53-1
Vacuum Leak Check Using PWA 50003 Carbon Seal Tester - General Procedures - - - - -	WP 024 00
Vacuum Leak Check Using Habco 1543003 Vacuum Air Flow Cart - General Procedures - - - - -	SWP 024 01
Air Flow Check Using PWA 50047 Pneumatic Test Set - General Procedures - - - - -	WP 025 00
Air Flow Check Using Habco 1093005 Portable Air Flow Checker - General Procedures - - - - -	SWP 025 01

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

Nomenclature	Specification/Vendor Part Number
COMPOUND, ANTIGALLING (PWA 36035)	FEL-PRO C-300
COMPOUND, ANTIGALLING (PWA 36545-3)	EVERLUBE 382
COMPOUND, ANTIGALLING (PWA 550-3)	HI-T-650
FLUID, LEAK CHECK	MIL-L-25567C
LOCKWIRE (0.032 INCH)	MS9226-04
OIL, LUBRICATING	MIL-L-6081, GRADE 1010
OIL, LUBRICATING	MIL-L-7808
PETROLATUM	VV-P-236

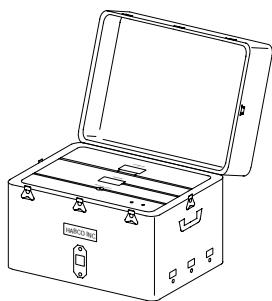
EXPENDABLE ITEMS

Nomenclature	Part Number	Quantity
GASKET	4061374	1
GASKET	ST2284-07	1
PACKING	MS9388-015	1
PACKING	MS9388-020	1
PACKING	ST1000-112	1
PACKING	ST2283-011	1
PACKING	ST2283-122	1
PACKING	ST2283-205	1

APPLICABLE SUPPORT EQUIPMENT

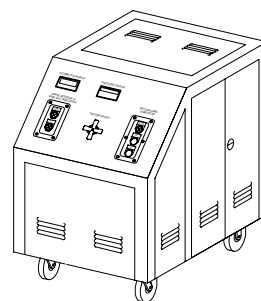
Paragraph	Function - Tool Nomenclature	Tool Number
2	NO. 5 BEARING OIL PRESSURE AND SCAVENGE TUBES - INSTALLATION FOR PRESSURE LEAK CHECK AND VACUUM CHECKS	
	COMPRESSOR, TUBE END GASKET - - - - -	PWA 56629 OR
	CRIMPER, NO. 5 BEARING INTERNAL PRESSURE AND SCAVENGE TUBE GASKET - - - - -	PWA 56320
	WRENCH, NO. 5 BEARING INTERNAL PRESSURE TUBE - - - -	PWA 51196
	ADAPTER, INSTALLER - - - - -	LM 1053
3	NO. 5 BEARING COMPARTMENT - AIRFLOW CHECK	
	TEST SET, PNEUMATIC - - - - -	PWA 50047 OR
	CHECKER, PORTABLE AIR FLOW - - - - -	HABCO 1093005
	ADAPTER - - - - -	PWA 56654 OR
	CONNECTOR - - - - -	PWA 51374
4	NO. 5 BEARING COMPARTMENT - VACUUM LEAK CHECK	
	TESTER, CARBON SEAL - - - - -	PWA 50003 OR
	CART, VACUUM AIR FLOW - - - - -	HABCO 1543003
	CAP - - - - -	MS9314-06
	ADAPTER - - - - -	PWA 51375
	ADAPTER - - - - -	PWA 56652 OR
	CONNECTOR - - - - -	PWA 51376
5	NO. 5 BEARING DAMPER SEALS - PRESSURE LEAK CHECK	
	PLUG SET, DAMPER SEAL PORTS - - - - -	PWA 57719
	ADAPTER WITH LOCALLY MANUFACTURED (LL, 10) QUICK DISCONNECT FITTING - - - - -	PWA 53789
6	NO. 5 BEARING OIL PRESSURE AND SCAVENGE TUBES - REMOVAL AFTER TESTING	
	WRENCH, NO. 5 BEARING INTERNAL PRESSURE TUBE - - - -	PWA 51196
	RETAINER, FAN DRIVE TURBINE REAR (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57824 OR
	RETAINER ASSY - - - - -	PWA 57709

ILLUSTRATED SUPPORT EQUIPMENT



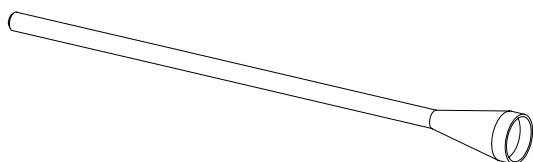
HABCO 1093005 -C

Figure T1. HABCO 1093005 CHECKER



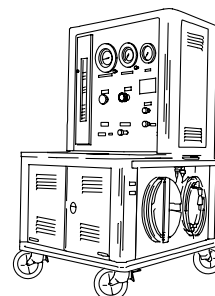
HABCO 1543003 -C

Figure T2. HABCO 1543003 CART



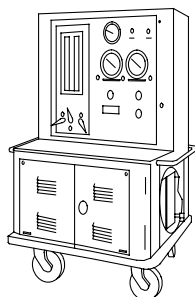
LM 1053 -C

Figure T3. LM 1053 ADAPTER



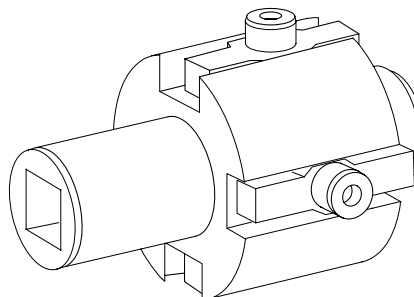
PWA 50003 -C

Figure T4. PWA 50003 TESTER



PWA 50047 -C

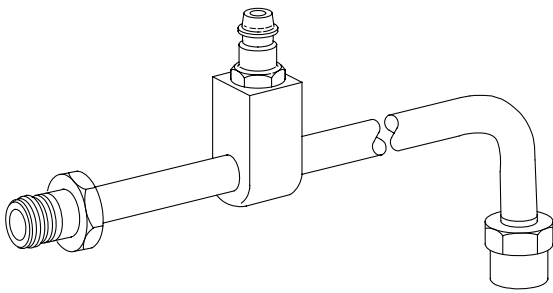
Figure T5. PWA 50047 TEST SET



PWA 51196 -C

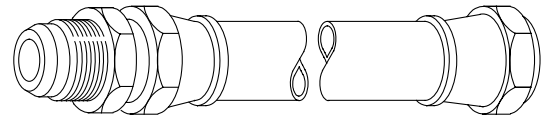
Figure T6. PWA 51196 WRENCH

ILLUSTRATED SUPPORT EQUIPMENT (continued)



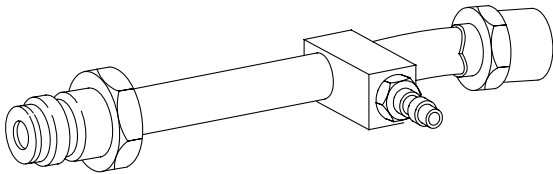
PWA 51374 -C

Figure T7. PWA 51374 CONNECTOR



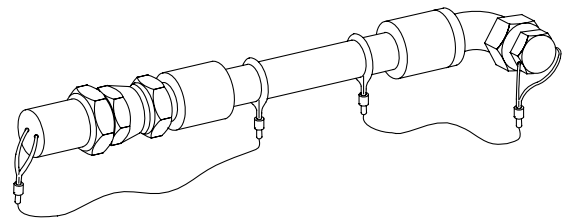
PWA 51375 -C

Figure T8. PWA 51375 ADAPTER



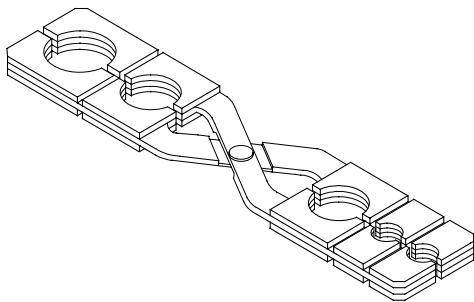
PWA 51376 -C

Figure T9. PWA 51376 CONNECTOR



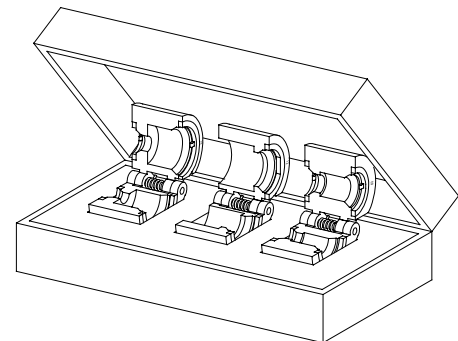
PWA 53789 -C

Figure T10. PWA 53789 ADAPTER



PWA 56320 -C

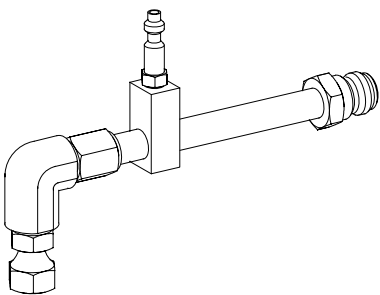
Figure T11. PWA 56320 CRIMPER



PWA 56629 -C

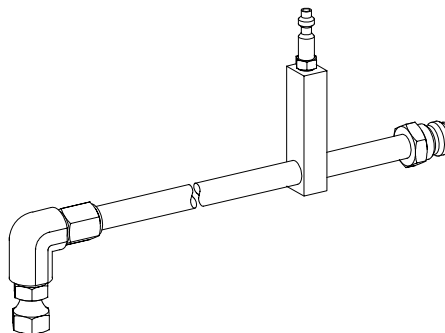
Figure T12. PWA 56629 COMPRESSOR

ILLUSTRATED SUPPORT EQUIPMENT (continued)



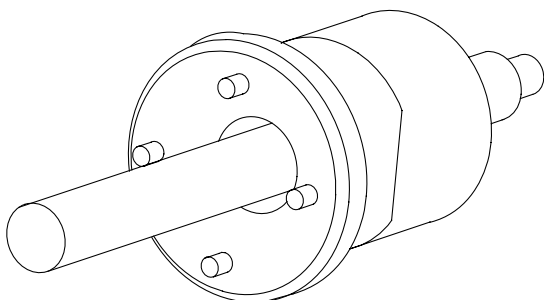
PWA 56652 -C

Figure T13. PWA 56652 ADAPTER



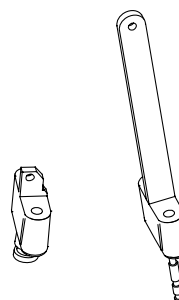
PWA 56654 -C

Figure T14. PWA 56654 ADAPTER



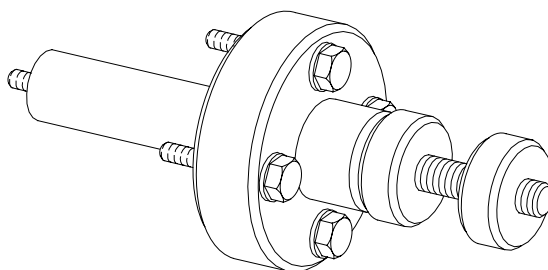
PWA 57709 -C

Figure T15. PWA 57709 RETAINER ASSY



PWA 57719 -C

Figure T16. PWA 57719 PLUG SET



PWA 57824 -C

Figure T17. PWA 57824 RETAINER

1. INTRODUCTION.

- a. This work package contains instructions for performing leak, airflow, and vacuum checks on No. 5 bearing compartment. First No. 5 bearing pressure tube is installed and damper seals leak check and airflow check are performed. Scavenge tube is installed and vacuum check is performed.

(d) Unthread shaft from No. 5 bearing plug.

**2. NO. 5 BEARING OIL PRESSURE AND
SCAVENGE TUBES - INSTALLATION FOR
PRESSURE LEAK CHECK AND VACUUM
CHECKS.**

(See Figures 1, 2 and 3.)

NOTE

Turbine rotor axial position may be secured by either PWA 57709 retainer or PWA 57824 retainer.

- a. Remove PWA 57709 retainer or PWA 57824 retainer from No. 5 bearing inner support as follows:

(1) Remove PWA 57709 retainer as follows: (See figure 1.)

(a) Unthread handle from base.

(b) Remove four screws securing base to No. 5 bearing inner support assembly. Remove base from shaft.

(c) Unthread shaft from No. 5 bearing plug.

(2) Remove PWA 57824 retainer as follows: (See figure 2.)

(a) Loosen knurled nut on shaft several turns.

(b) Remove four screws securing handle to No. 5 bearing inner support assembly.

(c) Rotate handle several turns counterclockwise on shaft.

- b. Install No. 5 bearing internal pressure tube(15, figure 3) as follows:

(1) Check old gaskets and packings for damage. If serviceable, it is permissible to use them for checks.

(2) Check that seal ring(16) is installed on tube(15). If necessary install seal ring and ensure gap is 0.021 to 0.050 inch.

(3) If necessary, remove protective caps from tube(15) and ensure old gasket(14) was removed from tube(15). Lubricate new gasket(14) with petrolatum and install on end of tube(15). Crimp gasket using PWA 56629 compressor.

(4) Lubricate tube(15) inner threads with Fel-Pro C-300 antigalling compound. Install tube and gasket through 12 o'clock strut of turbine exhaust case.

(5) Thread tube(15) into No. 5 seal assembly. Torque 300 to 330 pound-inches using PWA 51196 wrench.

(6) Lubricate packing(17) with lubricating oil and install on elbow(19).

(7) Insert filter element(21) into tube(15), then install elbow(19) into tube(15).

(8) Install bolts(18) with nut plates(20). Install nut plates with lips up and torque bolts 32 to 36 pound-inches.

c. Install No. 5 bearing internal scavenge tube(6) as follows:

- (1) Check that seal ring(11) is installed on tube(6). If necessary install seal ring and ensure gap is 0.021 to 0.050 inch.
- (2) If necessary, remove protective caps from tube(6) and ensure old gasket(5) was removed from tube(6). Lubricate new gasket(5) with petrolatum and install on end of tube(6). Crimp gasket using PWA 56629 compressor.

- (3) Lubricate tube(6) inner threads with Fel-Pro C-300 antigalling compound. Install tube and gasket through 6 o'clock strut of turbine exhaust case.
- (4) Thread tube(6) into No. 5 seal assembly. Torque 300 to 350 pound-inches using 7/16 inch six point socket wrench.
- (5) Lubricate packings(9 and 10) with lubricating oil and install on end of tube. Install tee(8) and nut(7) and torque 275 to 300 pound-inches.

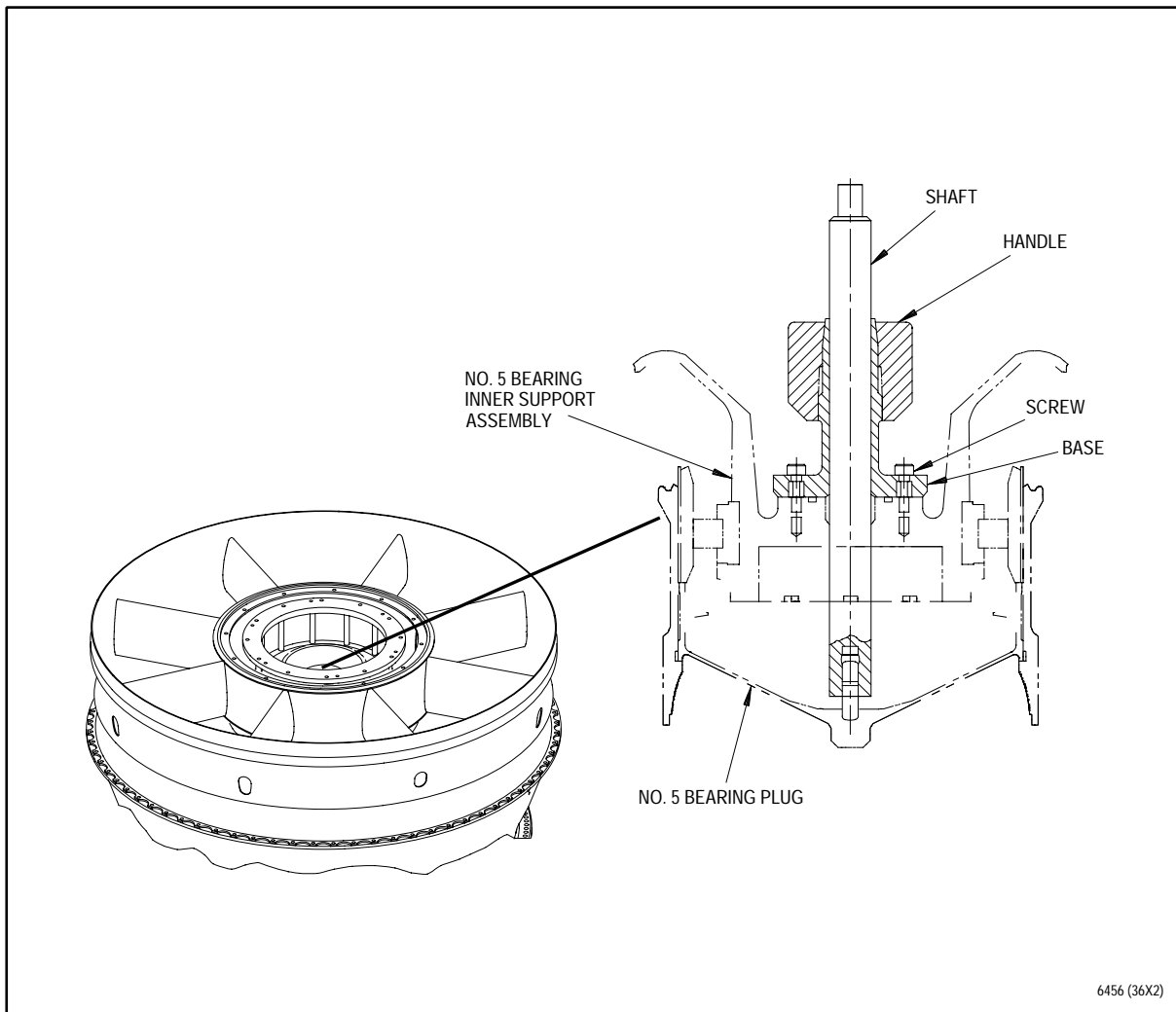


Figure 1. PWA 57709 Retainer - Removal

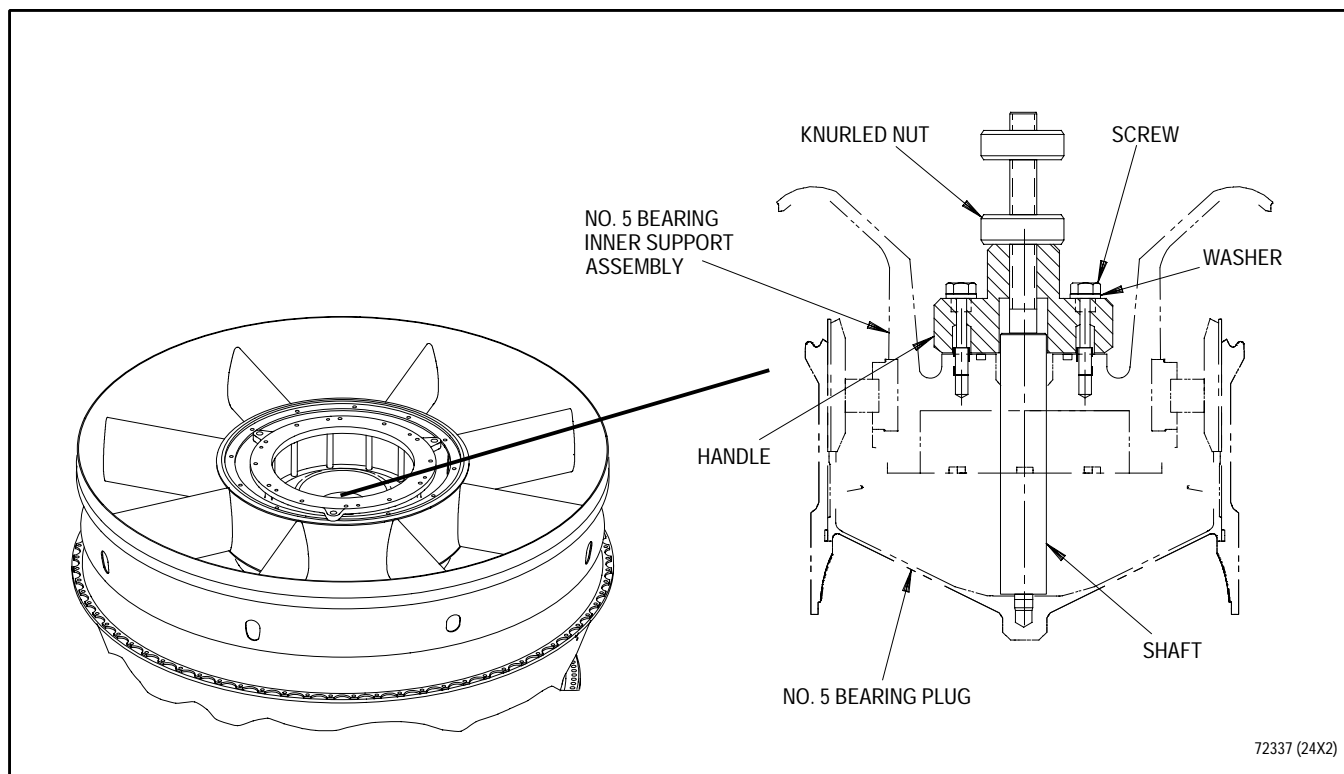
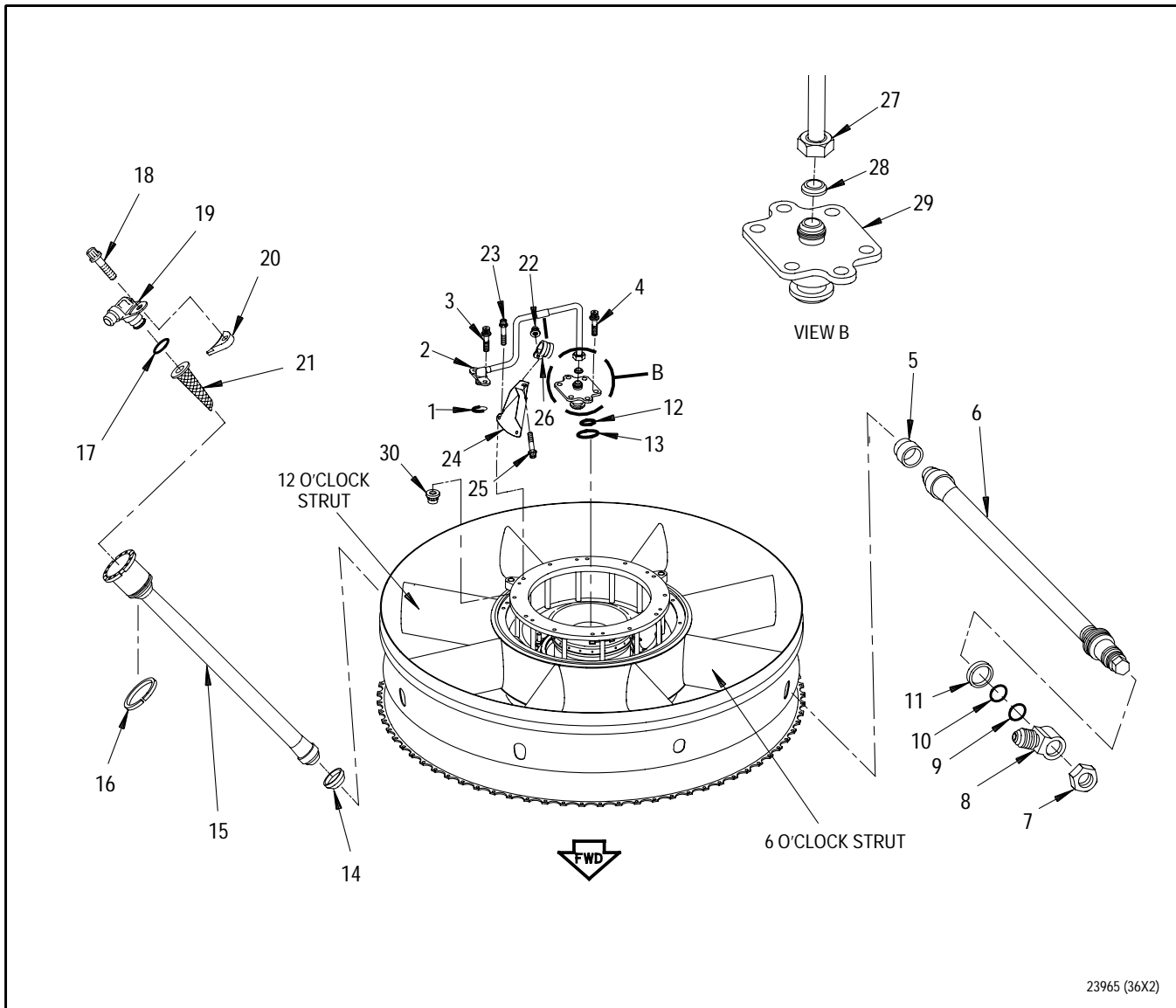


Figure 2. PWA 57824 Retainer - Removal



23965 (36X2)

- | | | |
|--|---|--------------------|
| 1. Packing ST 2283-011 | 11. Seal Ring | 21. Filter Element |
| 2. No. 5 Bearing Inner
Internal Oil Pressure Tube | 12. Packing ST 2283-205 | 22. Nut |
| 3. Bolts | 13. Packing ST 2283-122 | 23. Bolt |
| 4. Bolts | 14. Gasket ST 2284-07 | 24. Bracket |
| 5. Gasket 4061374 | 15. No. 5 Bearing Internal
Pressure Tube | 25. Bolt |
| 6. No. 5 Bearing Internal
Scavenge Tube | 16. Seal Ring | 26. Loop Clamp |
| 7. Nut | 17. Packing ST 1000-112 | 27. Tube Nut |
| 8. Tee | 18. Bolts | 28. Conical Gasket |
| 9. Packing MS9388-015 | 19. Elbow | 29. Adapter |
| 10. Packing MS9388-020 | 20. Nut Plates | 30. Nut |

Figure 3. No. 5 Bearing Oil Pressure and Scavenge Tubes - Installation for Airflow and Vacuum Checks

d. Install No. 5 bearing inner internal pressure tube(2) as follows:

- (1) Lubricate packings(1, 12, and 13) with lubricating oil, MIL-L-7808.
- (2) Install packing(1) on No. 5 bearing pressure tube(2) using LM 1053 adapter.
- (3) Place LM 1053 adapter, large diameter end, onto end of tube(2). Ensure packing(1) is coated with lubricating oil MIL-L-7808. Slide packing onto LM 1053 adapter small diameter end past large diameter into packing groove of tube(2).
- (4) Install packing(12) on adapter(29). Install packing(13) in groove on No. 5 bearing seal assembly.
- (5) Install adapter(29). Lubricate bolts(4) with lubricating oil, MIL-L-7808. Install bolts and torque 27 to 30 pound-inches.
- (6) Install conical gasket(28) on adapter(29).
- (7) Lubricate adapter(29) threads with PWA 36545-3 antigalling compound. Install tube assembly(2), aligning tube ferrule with adapter conical seat. Lubricate bolts(3) with PWA 36035 antigalling compound and install fingertight.
- (8) Tighten tube nut(27) fingertight.
- (9) Torque bolts(3) 27 to 30 pound-inches. Torque tube nut(27) 150 to 165 pound-inches.

- (10) Remove bolts(23) and nuts(30) at hole locations 1 and 2 on No. 5 bearing support.
- (11) Install bracket(24) and replace previously removed bolts(23) and nuts(30), fingertight.
- (12) Torque bolts(23) 27 to 30 pound-inches.

NOTE

Bracket should maintain contact with flange but be free to be moved to align with No. 5 bearing inner pressure tube assembly.

- (13) Back off bolts(23) until bracket(24) is free to move.
- (14) Install loop clamp(26) to tube assembly(2) and bracket(24). Lubricate bolt(25) with PWA36545-3 antigalling compound and install bolt(25) and nut(22) fingertight.
- (15) Torque bolt(25) 27 to 30 pound-inches.
- (16) Torque bolts(23) 27 to 30 pound-inches.

3. NO. 5 BEARING COMPARTMENT - AIRFLOW CHECK.

(See figure 3 and Figure 4.)

- a. If PWA 50047 pneumatic test set is being used, perform self-test. Refer to T.O. 2J-F100-53-1, WP 025 00.
- b. Install PWA 56654 connector on elbow(19, figure 3).
- c. Connect supply hose from PWA 50047 test set to large fitting on PWA 56654 connector.
- d. Connect gage pressure line from PWA 50047 test set to small fitting on PWA 56654 connector.
- e. Ensure scavenge tube tee(8) is open to atmosphere.

NOTE

No leakage limits have been established for No. 5 bearing compartment because of seal design. Leakage across No. 5 bearing seals is high compared to other bearing compartments. Rates will vary between modules and will usually be higher than leakage found at loose tubes or adapters.

- f. Perform airflow check. Use PWA 50047 pneumatic test set. Refer to T.O. 2J-F100-53-1, WP 025 00. Or use Habco 1093005 portable air flow checker. Refer to T.O. 2J-F100-53-1, SWP 025 01. Proceed as follows:
(See figure 4.)



Exceeding specified pressure may cause damage to carbon seal.

- (1) Apply 10 psig pressure to No. 5 bearing compartment.
- (2) Measure rate of airflow through nozzle. Airflow shall be between 7.5 and 13 phr.



Failure to prevent leak check fluid from entering oil tubes or No. 5 bearing compartment can result in oil system contamination.

- (3) Apply leak check fluid around inner and outer bolt circles of No. 5 bearing support. Ensure leak check fluid does not enter oil tubes or bearing compartment. No leaks allowed. (See figure 4.)

- g. Remove PWA 56654 connector.

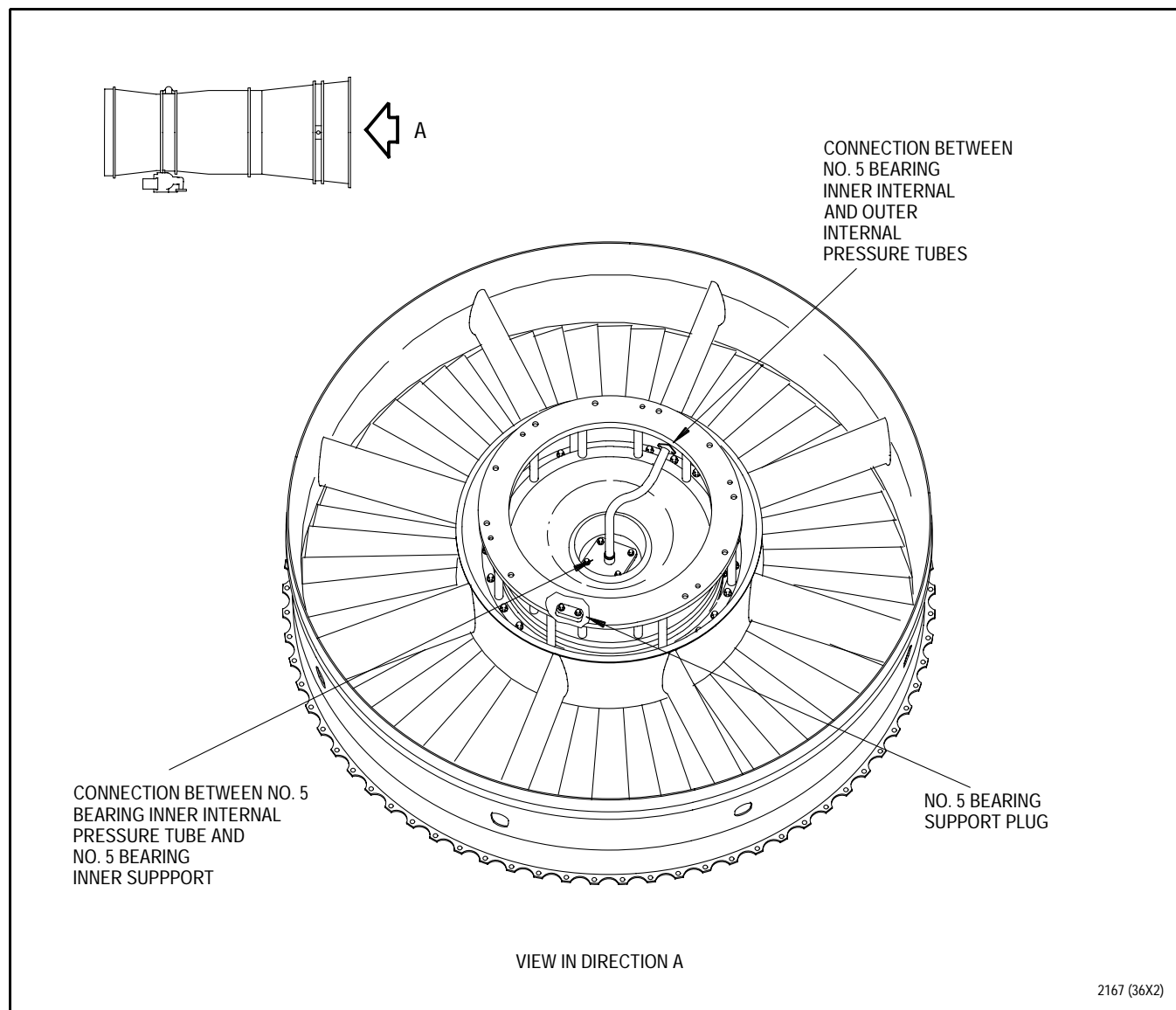


Figure 4. Identification of Areas Required Leak Check During No. 5 Bearing Compartment Airflow Check

4. NO. 5 BEARING COMPARTMENT - VACUUM LEAK CHECK.

(See figure 3.)

- a. If PWA 50003 vacuum air flow cart is being used, perform self-test. Refer to T.O. 2J-F100-53-1, WP 024 00.
- b. Vacuum leak check bearing compartment as follows:
 - (1) Install PN MS9314-06 cap assembly on end of elbow(19, figure 3). Torque 270 to 300 pound-inches.
 - (2) Install PWA 51375 adapter on tee(8).
 - (3) Install PWA 56652 adapter on PWA 51375 adapter.
 - (4) Connect large vacuum line from PWA 50003 tester or Habco 1543003 cart to large fitting on PWA 56652 adapter.

- (5) Connect small pressure gage line from PWA 50003 tester or Habco 1543003 cart to small fitting on PWA 56652 adapter.
- (6) Perform vacuum leak check. Use PWA 50003 tester. Refer to T.O. 2J-F100-53-1, WP 024 00. Or use Habco 1543003 cart. Refer to T.O. 2J-F100-53-1, SWP 024 01.
- (7) Airflow leakage shall not exceed 5.0 phr. Rotate turbine in a clockwise direction (viewed from rear) to seat carbon seal until lowest reading appears.
- (8) Remove tooling.

**5. NO. 5 BEARING DAMPER SEALS -
PRESSURE LEAK CHECK.**

(See figure 3 and Figure 5.)

- a. Remove No. 5 bearing pressure tube(2, figure 3) as follows:
 - (1) Loosen bolts(23) that attach bracket(24).
 - (2) Loosen bolt(25) attaching loop clamp(26).
 - (3) Remove bolts(23) and bolt(25).
 - (4) Remove bracket(24) and loop clamp(26).
 - (5) Loosen and disengage tube nut(27) from adapter(29).
 - (6) Remove bolts(3) and remove tube assembly(2) by applying force to elbow only.
 - (7) Discard packing(1) and gasket(28).
- NOTE**
- If adapter(29) removal is required, proceed to step (8).
- (8) Remove adapter(29) as follows:
 - (a) Remove bolts(4).
 - (b) Using jack screws, remove adapter(29).
 - (c) Discard packings(12 and 13).
 - b. Remove lockwire and two bolts(3, figure 5) securing No. 5 bearing support plug(2). Remove plug.

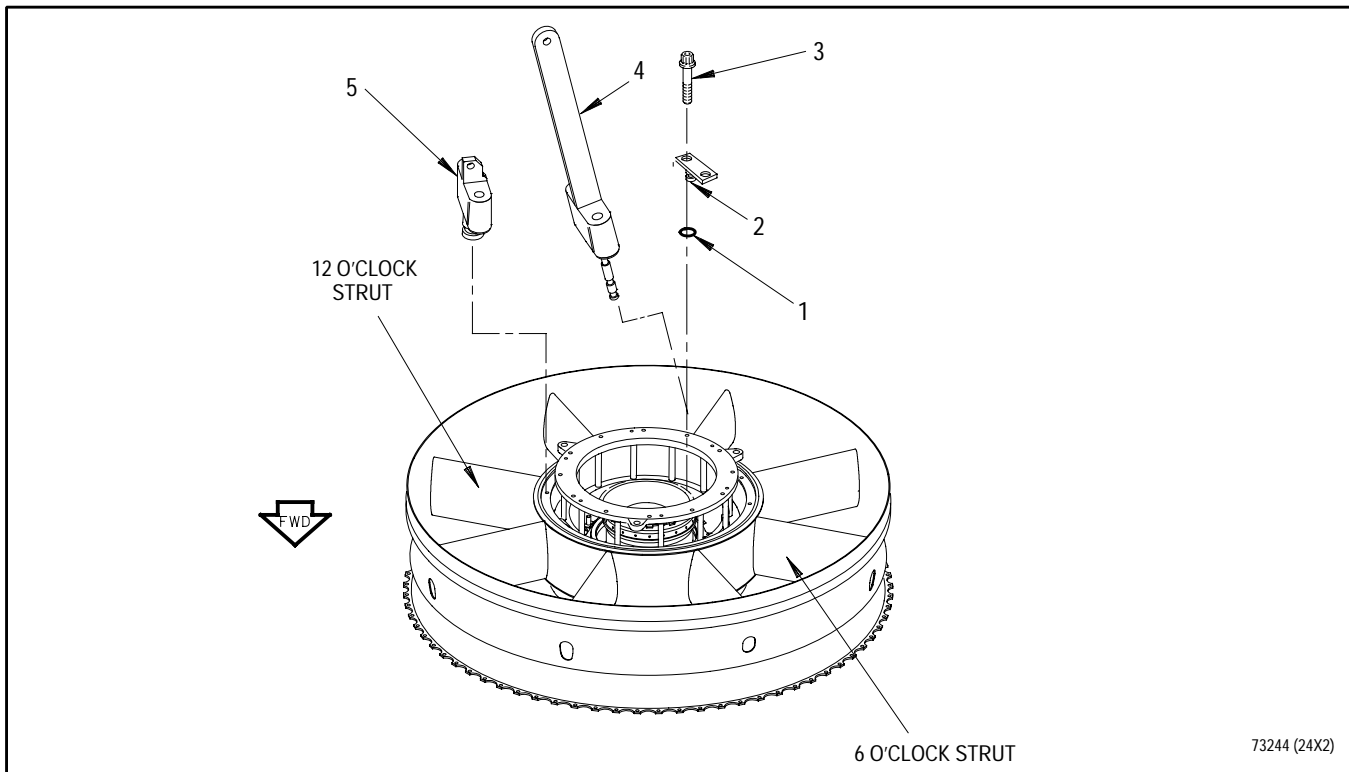
- c. Discard packings(1).
- d. Install PWA 57719 plug detail-10(4) into location from which support plug was removed.
- e. Torque bolts 32 to 36 pound-inches.
- f. Install PWA 57719 plug detail-14(5) into No. 5 bearing pressure tube port.
- g. Torque bolts 32 to 36 pound-inches.

NOTE

Gaseous nitrogen or carbon dioxide bottle must have minimum 500 psi pressure. Low pressure gage must be capable of reading at least 500 psig.

- h. Connect hose from bottle to elbow(19, figure 3) using PWA 53789 adapter with a locally manufactured (LL-10) quick-disconnect fitting.
- i. Slowly open regulator valve to pressurize No. 5 damper-seals between 95 to 105 psig and close off flow.
- j. Maximum pressure drop of 5 psi in 30 seconds is acceptable.
- k. Release pressure from No. 5 damper seal area and remove PWA 53789 adapter.

- l. Remove PWA 57719 plug detail-14 and detail-10 (4 and 5, figure 5).
- m. Coat ST2283-009 (1) packing with MIL-L-7808 lubricating oil.
- n. Install packing packing into No. 5 bearing support plug(2).
- o. Coat bolts(3) with Fel-Pro C-300 antigalling compound.
- p. Secure plug(2) with bolts(3) and torque bolts 32 to 36 pound-inches.
- q. Lockwire bolts(3) using MS9226-04 lockwire.



- | | |
|-------------------------------|---------|
| 1. Packing | 4. Plug |
| 2. No. 5 Bearing Support Plug | 5. Plug |
| 3. Bolts | |

Figure 5. PWA 57719 Plug Set - Installation and Removal

6. NO. 5 BEARING OIL PRESSURE AND SCAVENGE TUBES - REMOVAL AFTER TESTING.

(See figures 1, 2 and 3.)

- a. Remove No. 5 bearing outer internal pressure tube(15, figure 3) as follows:

- (1) Remove bolts(18) and nut plates(20).
- (2) Remove elbow(19) and filter element(21).
- (3) Loosen tube(15) using PWA 51196 wrench, then remove tube and gasket(14).

- b. Remove No. 5 bearing internal scavenge tube(6) as follows:

- (1) Remove nut(7), tee(8), and packings(9 and 10).
- (2) Loosen tube(6) using 7/16 inch six point socket wrench, then remove tube and gasket(5).

NOTE

Turbine rotor axial position may be secured using either PWA 57824 retainer per step c. or PWA 57709 retainer per step d.

- c. Install PWA 57824 retainer as follows: (See figure 2.)

- (1) Rotate knurled nut and handle counterclockwise on shaft toward knurled knob end of shaft.

- (2) Thread shaft into No. 5 bearing plug until shaft bottoms. Back off 1/4 to 1/2 turn.

- (3) Rotate handle clockwise on shaft until it contacts No. 5 bearing inner support assembly. Secure with four screws.

- (4) Handtighten knurled nut against handle.

- d. Install PWA 57709 retainer as follows: (See figure 1.)

- (1) Thread shaft into No. 5 bearing plug until shaft bottoms. Back shaft off 1/4 to 1/2 turn.

- (2) Slide base over shaft and seat base on No. 5 bearing inner support assembly, aligning holes.

- (3) Secure base with four screws.

- (4) Thread detail-3 handle onto base handtight.

- (5) Thread handle additional 1/3 turn using wrench.

- e. Install protective caps to all tubes.

WORK PACKAGE**TECHNICAL PROCEDURES****FAN DRIVE TURBINE MODULE -****TRANSFER FROM BUILD STAND TO PWA 10673 TRUCK****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 8

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	23	4	23	4B Blank Added	23
3	15	4A Added	23	5 - 6	15

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

None

CONSUMABLE MATERIALS

None

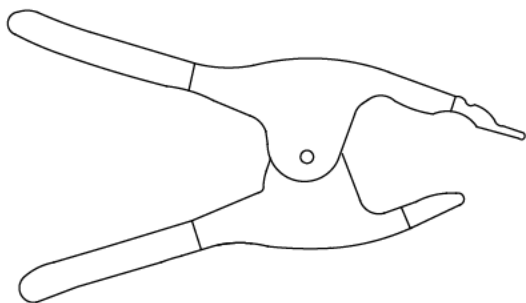
EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

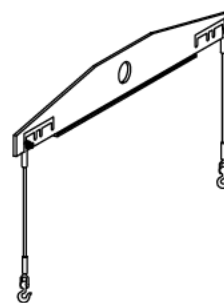
Paragraph	Function - Tool Nomenclature	Tool Number
2	FAN DRIVE TURBINE MODULE - TRANSFER FROM BUILD STAND TO PWA 10673 TRUCK	
	TRUCK, FRONT COMPRESSOR DRIVE TURBINE - - - - -	PWA 10673
	PROTECTOR, FRONT COMPRESSOR DRIVE TURBINE EXHAUST CASE - - - - -	PWA 52734
	SUPPORT, FRONT COMPRESSOR DRIVE TURBINE - - - - -	PWA 10687
	ADAPTER, LIFT AND TRUNNION, FAN DRIVE TURBINE MODULE (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57766
	ADAPTER, LIFT AND TRUNNION (TWO REQUIRED) - - - - -	PWA 26147
	SLING, HANDLING - - - - -	PWA 6580
	CLAMP - - - - -	LM 1021
	RETAINER, FAN DRIVE TURBINE MODULE FRONT (PART OF PWA 57833 TOOL SET) - - - - -	PWA 57819 OR
	RETAINER ASSEMBLY - - - - -	PWA 57648 OR
	RETAINER, FRONT, FAN DRIVE TURBINE MODULE - - - - -	PWA 56682
	EYE, LIFTING - - - - -	PWA 51056
	PROTECTOR, FRONT COMPRESSOR DRIVE TURBINE ROTOR AND STATOR, FRONT RETAINER - - - - -	PWA 52706
	PROTECTOR, SPLINE, FRONT COMPRESSOR DRIVE TURBINE SHAFT (FRONT) - - - - -	PWA 52647

ILLUSTRATED SUPPORT EQUIPMENT



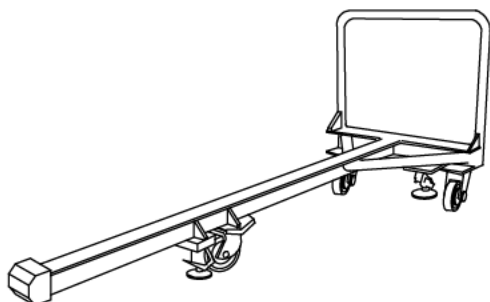
LM 1021 -C

Figure T1. LM 1021 Clamp



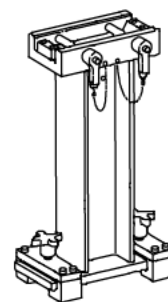
PWA 6580 -C

Figure T2. PWA 6580 Sling



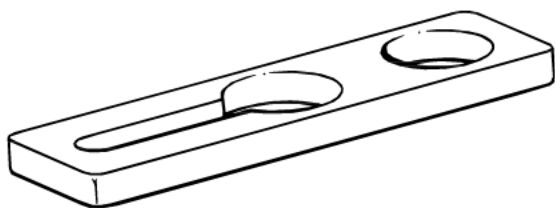
PWA 10673 -C

Figure T3. PWA 10673 Truck



PWA 10687 -C

Figure T4. PWA 10687 Support



PWA 26147 -C

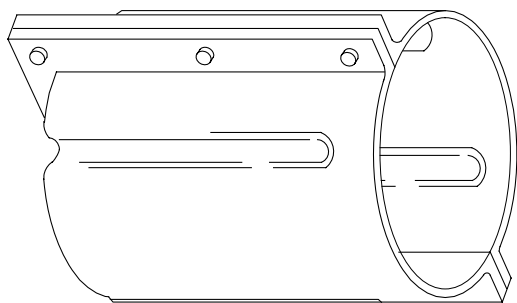
Figure T5. PWA 26147 Adapter



PWA 51056 -C

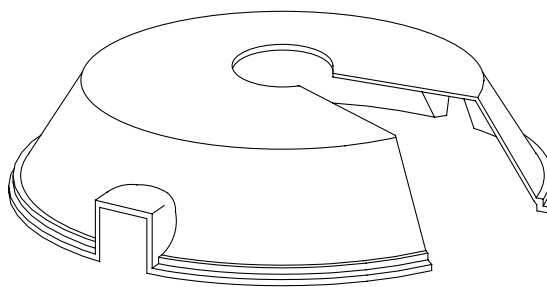
Figure T6. PWA 51056 Eye

ILLUSTRATED SUPPORT EQUIPMENT (continued)



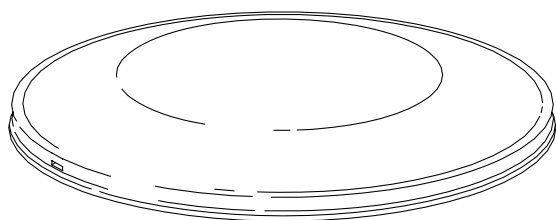
PWA 52647 -C

Figure T7. PWA 52647 PROTECTOR



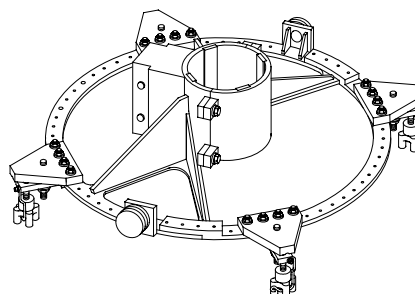
PWA 52706 -C

Figure T8. PWA 52706 PROTECTOR



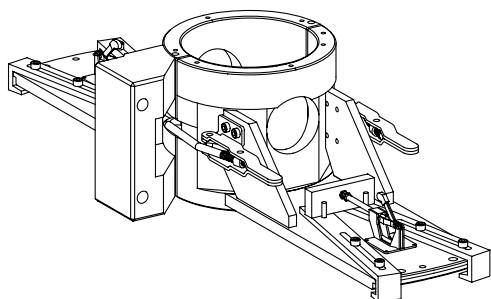
PWA 52734 -C

Figure T9. PWA 52734 PROTECTOR



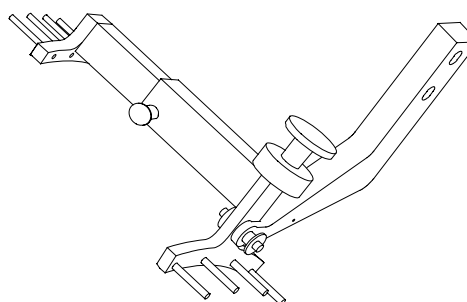
PWA 56682 -C

Figure T10. PWA 56682 RETAINER



PWA 57648 -C

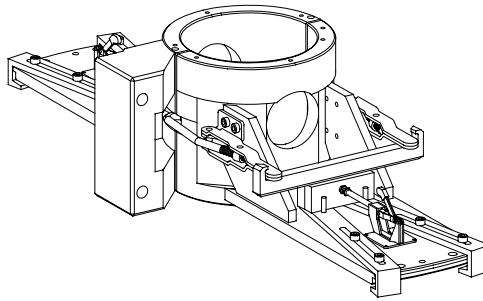
Figure T11. PWA 57648 RETAINER



PWA 57766 -C

Figure T12. PWA 57766 ADAPTER

ILLUSTRATED SUPPORT EQUIPMENT (continued)



PWA 57819 -C

Figure T13. PWA 57819 RETAINER

1. INTRODUCTION.

- a. This work package contains instructions for transferring fan drive turbine module from build stand to PWA 10673 truck following final assembly.

**2. FAN DRIVE TURBINE MODULE -
TRANSFER FROM BUILD STAND TO PWA 10673
TRUCK.**

(See Figure 1.)



Failure to install PWA 57824 retainer to maintain proper relationship between turbine rotor and stator can result in parts damage during module removal from build stand.

- a. Check that PWA 57824 retainer is installed in No. 5 bearing inner support. (See figure 1.) If necessary, install retainer per WP 701 00.
 - b. Install PWA 52734 protector over rear of turbine exhaust case.
 - c. Install PWA 10687 support on PWA 10673 truck.
 - d. Install PWA 57766 adapters between Flanges W and Z.
 - e. Install PWA 26147 adapters on trunnion spools of PWA 57766 adapters. Connect PWA 6580 sling to adapters and to an overhead hoist.
- f. Raise module until forward flange of turbine case is several inches above flange of build stand. Ensure second stage turbine support and duct set is still installed in turbine case. Install two LM 1021 clamps 180 degrees apart to hold support in place.
 - g. Raise module from build stand enough to install PWA 57819 front retainer.
 - h. Install PWA 57819 front retainer and clamp to front flange of turbine case. Ensure lock tabs of detail-17 pusher engage shaft clamp toggle handles. Remove two LM 1021 clamps.
 - i. Install PWA 51056 lifting eye on front of turbine shaft.
 - j. Remove fan drive turbine module from build stand.
 - k. Connect an overhead hoist to PWA 51056 lifting eye and rotate fan drive turbine module to a horizontal position.
 - l. Lower module into PWA 10673 truck. Secure module by engaging PWA 57819 front retainer with PWA 10687 support. Lock in place with ball lock pins.
 - m. Disconnect overhead hoists. Remove PWA 6580 sling, PWA 26147 adapters, and PWA 51056 lifting eye.
 - n. Install PWA 52706 protector over front of turbine case.
 - o. Install PWA 52647 protector over turbine shaft splines.



Second stage turbine support and duct set is loose fit inside rear turbine case and will be damaged if allowed to fall from case during handling.

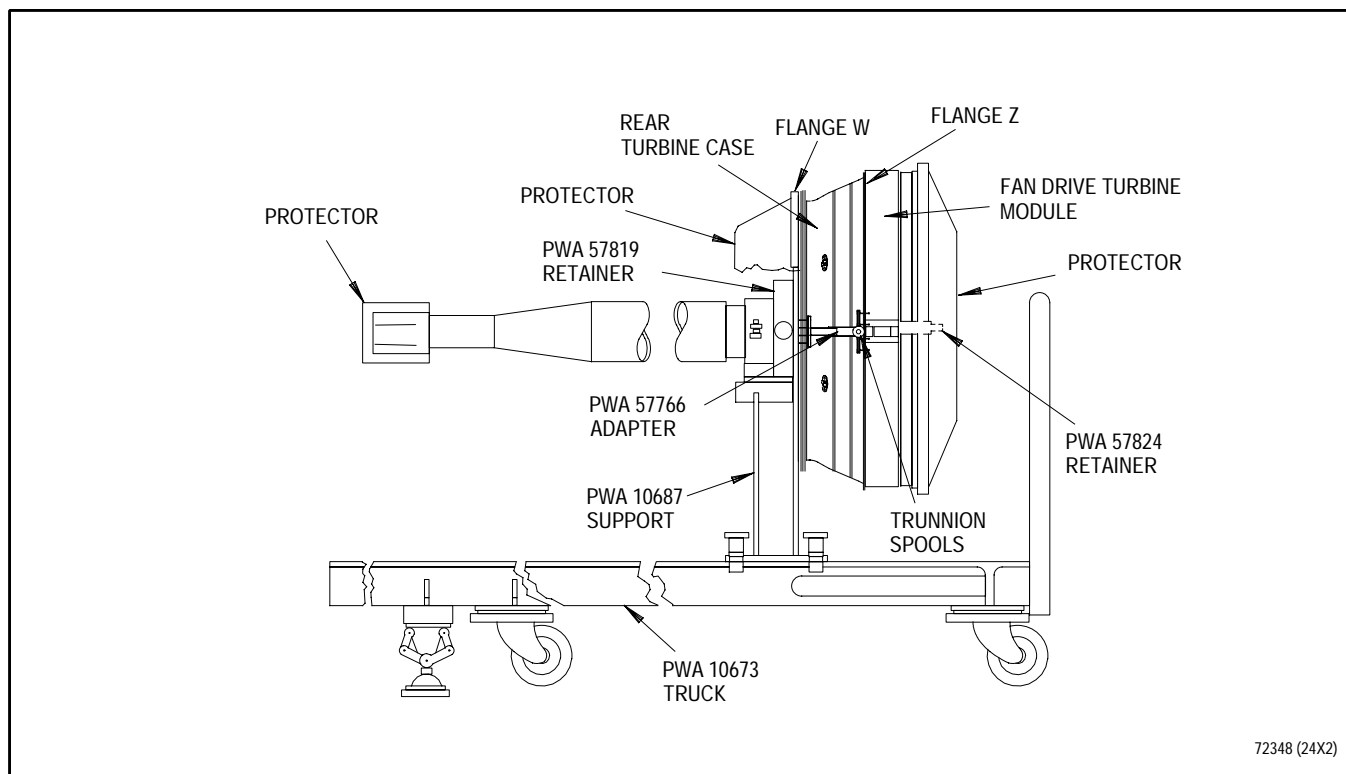


Figure 1. Fan Drive Turbine Module Installed in PWA 10673 Truck

WORK PACKAGE

INTRODUCTION

FAN DRIVE TURBINE MODULE -

TABLE OF LIMITS AND CLEARANCE CHARTS

EFFECTIVITY: ENGINE MODEL F100-PW-229

LIST OF EFFECTIVE WP PAGES

Total Number of Pages in this WP is 2

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2					0

T.O. 2J-F100-53-9

WP 800 00

1. INTRODUCTION.

This work package introduces the 800 00 and up series of work packages for the fan drive turbine module. This series provides Table of Limits and Clearance Charts. The following work packages are included in this series:

WP No.	Title
801 00	Fan Drive Turbine Module - Table of Limits and Clearance Charts
802 00	Open
and up	

WORK PACKAGE**TECHNICAL PROCEDURES****FAN DRIVE TURBINE MODULE -****TABLE OF LIMITS AND CLEARANCE CHARTS****EFFECTIVITY: ENGINE MODEL F100-PW-229****LIST OF EFFECTIVE WP PAGES**

Total Number of Pages in this WP is 14

PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.	PAGE NO.	CHANGE NO.
1 - 2	26	12 Blank	20	13	20
3 - 11	20			14 Blank	20

T.O. 2J-F100-53-9

WP 801 00

REFERENCE MATERIAL REQUIRED

None

APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS

T. O. No.	Date	Level	Title (ECP No.)
2J-F100229(III)-510	15 JUN 98	D	Modification of PN 4081129 No. 5 Bearing Inner Support to Provide Optimized No. 5 Bearing Fit, F100-PW-229 Engines, F-15/F-16 Aircraft. (ECP 92QA031)

CONSUMABLE MATERIALS

None

EXPENDABLE ITEMS

None

APPLICABLE SUPPORT EQUIPMENT

None

ILLUSTRATED SUPPORT EQUIPMENT

None

1. INTRODUCTION.

- a. This work package contains dimensional limits and torque values for the fan drive turbine module.

2. GENERAL INSTRUCTIONS.

(See FO-1 and Tables 1 through 3.)

- a. Fan drive turbine module dimensional limits and torque values are contained in five tables:
 - Table 1 - Fits and Clearances
 - Table 2 - Blade Tip Radial Clearances
 - Table 3 - Torque Limits
 - Table 4 - Spring Pressures
- b. Entries in the tables have reference numbers which are also located in FO-1. This illustration identifies the parts and indicates where spring pressures, fits and special torque values apply. Further information on interpreting fits, clearances, terms and symbols is provided in T.O. 2-1-111.

3. LIMITS.

- a. Limits without a single asterisk (*) or double asterisk (**) appearing in the limits column have a Replace If Over tolerance added to either the Minimum or Maximum limit, or both.
- b. Limits with a single asterisk (*) appearing in the limits column have no Replace If Over tolerance assigned.

- c. Limits with a double asterisk (**) appearing in either the Minimum or Maximum limits column, or both, have been assigned a Replace If Over clearance limit identical to the respective blueprint clearance limit.

4. TERMS AND SYMBOLS.

- a. Symbol T in Minimum and Maximum in Tables of Limits column indicates tight fit.
- b. Unless otherwise specified, all fits are diametrical, except spline fits which are calculated from chordal dimensions.
- c. Letter-number codes enclosed within a circle on limits charts, such as A12, are of contractor significance only and shall be ignored.
- d. Letter-number codes within parentheses, such as (C-8), relate to coordinates on the outer margins of each clearance chart to facilitate location.

5. UNITS.

- a. Figures in Minimum and Maximum columns in Tables of Limits and Clearances shall be interpreted as follows: Torque in pound-inches, spring pressure in pounds, and all other limits in inches.

**Table 1. Fits and Clearances
(See FO-1.)**

Ref No.	Name	Dimensions for Ref		Limits	
		Min	Max	Min	Max
4101	Radial clearance 3rd stage turbine air sealing ring segments - - - - -				
	Stator vane - - - - -			.000*	.029*
4102	Radial clearance 3rd stage turbine stator vane - - - - -	.126	.134		
	Rear turbine case - - - - -	.142	.146	.008*	.020*
4103	2nd Stage turbine duct Support - - - - -	25.526	25.530		
	Rear turbine case - - - - -	25.530	25.534	.000	.008
4104	Slide clearance No. 5 bearing housing Seal - - - - -	.349	.353		
	Helical compression spring seat - - - - -	.341	.343	.006*	.012*
4105	No. 5 bearing seal support pin - - - - -	.255	.257		
	Helical compression spring seat - - - - -	.263	.267	.006*	.012*
4106	Radial clearance 3rd stage turbine air sealing ring segment - - - - -	.083	.093		
	Rear turbine case - - - - -	.099	.107	.006	.024
4107	Radial clearance 4th stage turbine stator vane - - - - -	.115	.125		
	Rear turbine case - - - - -	.132	.136	.007**	.021
4108	Radial clearance 4th stage turbine stator vane - - - - -				
	Rear turbine case - - - - -			.000*	.033*
4109	4th stage turbine air sealing ring - - -	29.902	29.907		
	Rear turbine case - - - - -	29.903	29.907	.005*	.004T*
	4th stage turbine air sealing ring - - -	29.975	29.979		
	Turbine exhaust case - - - - -	29.975	29.979	.004	.004T*
4110	Radial clearance 3rd stage air sealing ring and rear turbine case - - - - -			.003	.039
	4th stage turbine stator vane - - - - -			.002	.042
4111	Air seal radial clearance 3rd stage turbine air seal (front) - - - - -	16.543	16.557		
	Sealing ring (front) - - - - -	16.572	16.568	.0055*	.0145*
	3rd stage turbine air seal (rear) - - -	16.743	16.757		
	Sealing ring (rear) - - - - -	16.772	16.768	.0055*	.0145*

Table 1. Fits and Clearances (continued)

Ref No.	Name	Dimensions for Ref		Limits	
		Min	Max	Min	Max
4112	3rd stage turbine air sealing ring - - - -	7.514	7.518		
	Disk - - - - -	7.518	7.522	.000*	.008T*
4113	Air seal radial clearance 4th stage				
	turbine air seal (Front) - - - - -	14.781	14.795		
	Sealing ring (Front) - - - - -	14.808	14.812	.0065*	.0155*
	4th stage turbine air seal (Middle) - - -	14.931	14.945		
	Sealing ring (Middle) - - - - -	14.958	14.962	.0065*	.0155*
	4th stage turbine air seal (Rear) - - - -	15.081	15.095		
	Sealing ring (Rear) - - - - -	15.108	15.112	.0065*	.0155*
4114	2nd Stage turbine duct support - - - - -	25.811	25.817		
	Rear turbine case - - - - -	25.817	25.823	.000	.012
4115	Turbine front compressor drive shaft - -	5.570	5.571		
	Turbine rear hub - - - - -	5.563	5.565	.005T**	.008T**
4116	3rd stage turbine disk - - - - -	9.499	9.503		
	Turbine rear hub - - - - -	9.495	9.499	.000T**	.008T**
	4th stage turbine disk - - - - -	9.589	9.593		
	Turbine rear hub - - - - -	9.585	9.589	.000T**	.008T**
4117	Radial clearance				
	Ring segment - - - - -	.072	.080		
	Rear turbine case - - - - -	.099	.107	.019	.035
4118	Rear turbine case - - - - -	31.123	31.133		
	4th stage air sealing ring - - - - -	31.152	31.156	.019*	.033*
4119	Turbine tie rod - - - - -	.375	.377		
	Rear turbine hub - - - - -	.380	.384	.003*	.009*
4120	Air seal radial clearance 4th stage				
	turbine air seal ring - - - - -	8.823	8.827		
	Sealing ring - - - - -	8.765	8.773	.025**	.071*
4121	4th stage turbine air sealing ring - - -	12.347	12.357		
	Turbine exhaust case - - - - -	12.358	12.368	.001**	.021**
4122	No. 5 bearing seal support - - - - -	11.352	11.356		
	Turbine exhaust case - - - - -	11.356	11.363	.000**	.011T**
4123	Turbine front compressor driveshaft - -	5.620	5.621		
	No. 5 bearing heat shield - - - - -	5.612	5.613	.007T	.009T**
4124	Turbine shaft stiffener - - - - -	5.146	5.150		
	Front compressor drive shaft - - - - -	5.128	5.136	.010T*	.022T*
4125	Turbine shaft stiffener - - - - -	4.999	5.001		
	Turbine front compressor driveshaft - -	4.998	5.002	.003T*	.003*

Table 1. Fits and Clearances (continued)

Ref No.	Name	Dimensions for Ref		Limits	
		Min	Max	Min	Max
4126	Turbine front compressor driveshaft - - -	5.826	5.827		
	Turbine rear hub - - - - -	5.816	5.820	.005T*	.011T*
4127	No. 5 bearing plug - - - - -	4.912	4.914		
	Turbine front compressor driveshaft - - -	4.905	4.907	.005T*	.009T*
4128	No. 5 bearing support (PN 4076393) - - -	3.1526	3.1534		
	Cylindrical roller bearing - - - - -	3.1493	3.1496	.0030T*	.0041T*
4128	No. 5 bearing support (PN 4081128) - - -	3.1507	3.1513		
	Cylindrical roller bearing - - - - -	3.1492	3.1496	.0011T*	.0021T*
4129	Cylindrical roller bearing - - - - -	4.9209	4.9213		
	Turbine front compressor driveshaft - - -	4.9183	4.9189	.0020T*	.0030T*
4130	No. 5 bearing seal support - - - - -	10.694	10.696		
	No. 5 bearing inner support - - - - -	10.690	10.694	.000*	.006T*
4131	No. 5 bearing seal support - - - - -	12.235	12.245		
	Turbine exhaust case - - - - -	12.250	12.261	.005*	.026*
4132	4th stage turbine air sealing ring - - - -	.167	.169		
	Ring segment - - - - -	.169	.177	.000*	.010*
4133	Turbine exhaust case - - - - -	31.120	31.130		
	4th stage air sealing ring - - - - -	31.152	31.156	.022*	.036*
4134	Turbine front compressor driveshaft - - -	5.380	5.381		
	No. 5 bearing seal seat - - - - -	5.384	5.385	.003*	.005*
4137	Gap - - - - -				
	Metal seal ring - - - - -				
	Seal ring gap at 6.350 basic - - - - -	.060	.080		
	Support - - - - -	6.349	6.351	.057	.083
4138	Turbine front compressor driveshaft outer rear spline - - - - -	.0738	.0770		
	Rear turbine inner spline - - - - -	.0825	.0857	.0055*	.0119*
4139	Slide clearance - - - - -				
	Metal seal ring - - - - -	.119	.124		
	No. 5 bearing seal support - - - - -	.127	.130	.003*	.011*
4140	Turbine front compressor driveshaft - - -	5.534	5.536		
	No. 5 bearing heat shield - - - - -	5.526	5.528	.006T**	.010T**

Table 1. Fits and Clearances (continued)

Ref No.	Name	Dimensions for Ref		Limits	
		Min	Max	Min	Max
4141	3rd stage turbine air seal - - - - -	15.618	15.622		
	3rd stage turbine disk - - - - -	15.604	15.609	.009T*	.018T*
4142	End clearance - - - - -				
	4th stage turbine rotor blade air seal			.005*	.019*
4143	End pinch				
	4th stage turbine air seal - - - - -	2.788	2.794		
	Rear turbine hub - - - - -	.337	.341		
	and				
	3rd stage turbine disk (free state)				
	dim - - - - -	1.323	1.327		
	and				
	4th stage turbine disk (free state)				
	dim - - - - -	1.112	1.116	.004T**	.022T
4148	4th stage turbine air seal (4073146) -	14.661	14.666		
	Disk - - - - -	14.656	14.660	.001T**	.010T**
4148	4th stage turbine air seal (4082297) -	13.929	13.933		
	Disk - - - - -	13.924	13.928	.001T**	.009T**
4149	Side clearance				
	Key washer - - - - -	.320	.330		
	Externally threaded bearing retaining				
	nut - - - - -	.370	.380	.040*	.060*
4150	Side clearance				
	Key washer - - - - -	.320	.330		
	Plain round nut - - - - -	.370	.380	.040*	.060*
4151	No. 5 bearing face seal (seal face to				
	extreme end of housing) - - - - -			1.660*	1.670*
4152	No. 5 bearing seal support pin - - - -	.3444	.3448		
	Support - - - - -	.3430	.3440	.0004T*	.0018T*
4153	Helical compression				
	Spring retainer lock - - - - -	2.2465	2.2475		
	Turbine front compressor driveshaft -	2.2445	2.2455	.001T*	.003T*
4154	Shoulder pin - - - - -	.3308	.3316		
	Turbine rear hub - - - - -	.3295	.3305	.0001T*	.0021T*
4155	Shoulder pin - - - - -	.300	.301		
	3rd stage turbine disk - - - - -	.302	.304	.001*	.004*

Table 1. Fits and Clearances (continued)

Ref No.	Name	Dimensions for Ref		Limits	
		Min	Max	Min	Max
4156	Shoulder pin - - - - -	.300	.301		
	4th stage turbine disk - - - - -	.302	.304	.001*	.004*
4157	Turbine shaft stiffener - - - - -	5.146	5.150		
	Turbine front compressor driveshaft				
		5.128	5.136	.010T*	.022T*
4158	Turbine shaft stiffener - - - - -	4.999	5.001		
	Turbine front compressor driveshaft				
		4.998	5.002	.003T*	.003*
4159	4th stage turbine air seal - - - - -	14.403	14.407		
	3rd stage turbine disk - - - - -	14.398	14.402	.001T**	.009T**
4160	End clearance 3rd stage turbine rotor blade - - - - -				
	Air seal - - - - -			.002T**	.032L**
4164	Helical compression spring seat - - -	.3444	.3448		
	No. 5 bearing seal support - - - - -	.3430	.3440	.0004T*	.0018T*
4165	Helical compression spring seat - - -	.154	.156		
	No. 5 bearing seal housing - - - - -	.167	.170	.009*	.016*
4166	Helical compression spring seat - - -	.154	.158		
	No. 5 bearing seal plate - - - - -	.161	.165	.003*	.011*
4167	2nd stage turbine seal pinch (This is a radial fit. Greater than hand pressure is required to obtain proper sealing, 20 places.) - - - -			.005*	.001T*
4168	3rd stage turbine air seal - - - - -	.1850	.1950		
	Pin - - - - -	.1630	.1635	.0215*	.0320*
4169	Headless shoulder pin - - - - -	.12475	.12575		
	No. 5 bearing seal support - - - - -	.12415	.12475	.0000*	.0011T*
4170	Headless shoulder pin - - - - -	.18725	.18775		
	Rear turbine case - - - - -	.18500	.18700	.00025T*	.00275T*
4171	End clearance				
	Rear turbine case 3rd stage turbine stator vane - - - - -			.004	.036
4172	End clearance				
	Rear turbine case 4th stage turbine stator vane - - - - -			.020	.074
4176	3rd stage turbine disk - - - - -	.1850	.1950		
	Headless shoulder pin - - - - -	.1630	.1635	.0215*	.0320*
4180	2nd stage turbine air seal pinch (This is a radial fit. Greater than hand pressure is required to obtain proper sealing, 20 places.)			.005*	.001T*

Table 1. Fits and Clearances (continued)

Ref No.	Name	Dimensions for Ref		Limits	
		Min	Max	Min	Max
4181	Axial clearance - - - - -				
	4th stage turbine air sealing ring segment with turbine case - - - - -			.000*	.020*
4182	4th stage turbine air sealing support ring - - - - -	11.164	11.168		
	Turbine exhaust case - - - - -	11.156	11.162	.002T*	.012T*
4183	4th stage turbine air sealing support ring - - - - -	12.829	12.833		
	4th stage turbine brush seal - - - - -	12.819	12.823	.006T*	.014T*
4184	4th stage turbine disk - - - - -	14.139	14.143		
	4th stage turbine air sealing ring - -	14.155	14.159	.012T*	.020T*

**Table 2. Blade Tip Radial Clearance
(See FO-1.)**

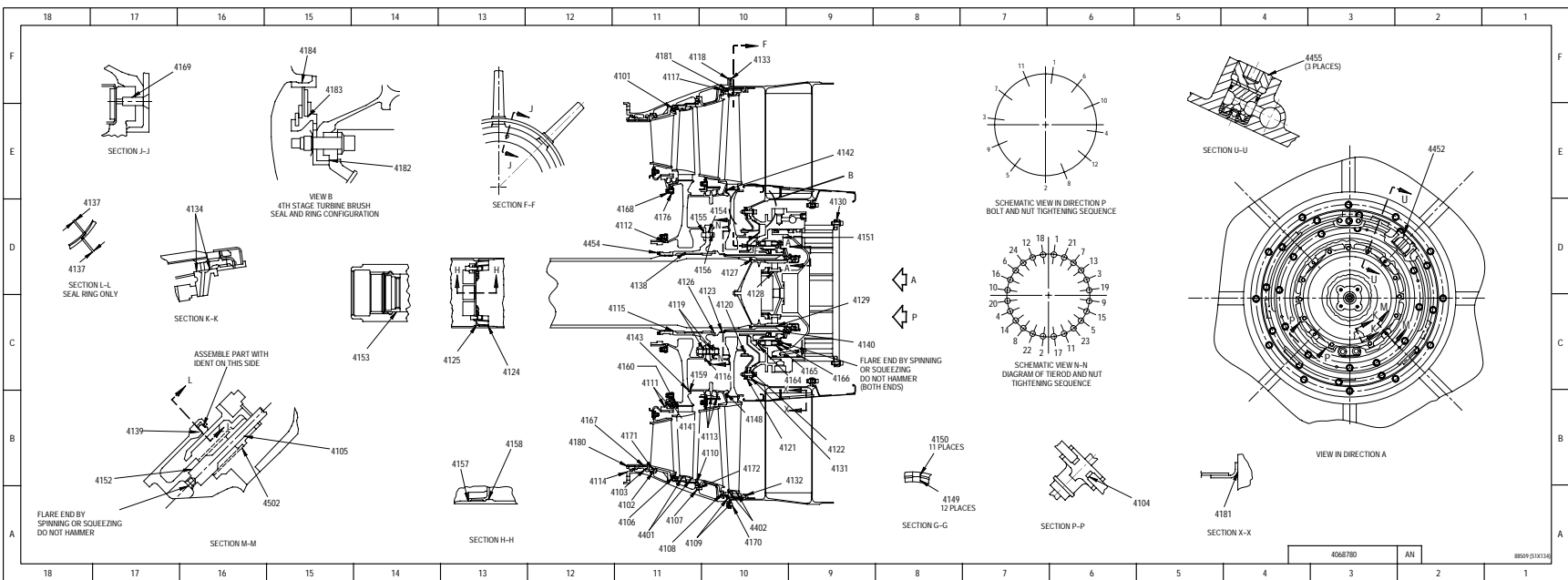
Ref No.	Name	Dimensions for Ref		Limits	
		Min	Max	Min	Max
NOTE					
If grooving is present in seal lands and groove is wider than 0.070 inch, blade/ seal clearances shall be taken in groove.					
4401	3rd stage turbine rotor blade air sealing ring (Front)			.037	.075
	3rd stage turbine rotor blade air sealing ring (Rear)			.037	.075
4402	4th stage turbine blade front seal ring segment (4082704)			.054	.136
	4th stage turbine blade rear seal ring segment (4082704)			.054	.136
4402	4th stage turbine blade seal ring segment (4082504)			.054*	.094*

**Table 3. Torque Limits
(See FO-1.)**

Ref No.	Name	Limits	
		Min	Max
4452	No. 5 bearing support ball socket seat - - - - -	2750	3000
4454	Front compressor driveshaft nut 1. Tighten nut 3700 to 3900 lb-in., turn nut through angle of 13° to 15° 30' and loosen nut to zero lb-in. 2. Tighten nut 3700 to 3900 lb-in. 3. Align pointer of PWA 51723 indicator with zero on protractor and secure to shaft. 4. Turn nut through angle of 13° to 15° 30'. 5. Loosen nut to zero lb-in. and repeat step 2. 6. If PWA 51723 pointer is at zero or beyond it within 1° 30' maximum, apply final angle of turn of 13°. If necessary, turn nut up to an additional 2° 30' for slot alignment. 7. If PWA 51723 zero point does not repeat within limits of step 6., repeat steps 3., 4., and 5., in order, until reference points are within limits; then perform step 6. 8. Install key washer and retaining ring to locknut.		
4455	No. 5 bearing seal assembly	30	50

**Table 4. Spring Pressures
(See FO-1.)**

Ref No.	Name	Limits	
		Min	Max
4502	Helical compression spring at 1.6630 inch at 0.6832 inch	0.5625* 2.4375*	0.6875* 2.6875*



FO-1. Fan Drive Turbine Module Clearance Chart

